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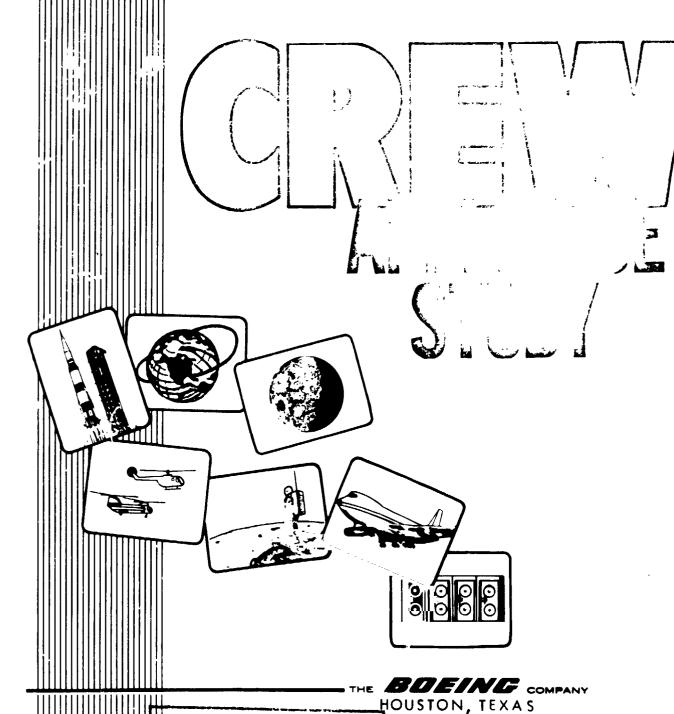
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### CREW APPLIANCE CONCEPTE



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July 25, 1975

#### DOCUMENT NO. D2-118561-5

### TITLE CREW APPLIANCE CONCEPTS

Contract NAS 9-13965

July 18, 1975

### Prepared by

B. W. Proctor R. P. Reysa D. J. Russell

CREW APPLIANCE CONCEPTS

APPENDIX C

MODULAR SPACE STATION APPLIANCES

SUPPORTING ENGINEERING DATA

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HABITABILITY SUBSYSTEM

Housekeeping

#### APPLIANCE FUNCTIONS CONSIDERED

- 3.1.1 Surface Wiping
  3.2.1 Manual Collection
  3.2.2 Vacuum Collection
  3.2.3 Refuse Transfer
  3.2.4 Pofuse Processing
- 3.2.4 Refuse Processing 3.2.5 Refuse Disposal
- 3.2.1 Washing 3.3.2 Drying
- 3.3.3 Washing/Drying Combination

DESCRIPTION The housekeeping habitability subsystem was designed to provide the cleanup, collection, processing, transfer and storage of refuse generated during a mission and crewman garment/linen maintenace. The study assumed refuse transfer would be accomplished manually for the missions under consideration. Longer term missions may eventually require some forms of automatic transfer. The housekeeping routines and equipment interface with all of the crew tasks, including experiments, medical research and care, system operations, dining, recreation, sleep, and personal hygiene.

HABITABILITY SUBSYSTEM_	3.0	Housekeeping			
HABITABILITY FUNCTION	3.1	Equipment Cleaning	٠,		
APPLIANCE FUNCTION	3.1.1	Surface Wiping			
Number of concepts cons	I DERED_	12	•	•	

#### **ASSUMPTIONS**

(1) Equipment cleaning includes all methods which use a moist wipe, cloth or

sponge and a means of drying the item cleaned.

(2) The equipment cleaning function was assumed to be performed 15 times per day. Three times for meal cleanup, six times for cleanups of the personal hygiene area, three times for cleanup of spills, etc., and two for continency cleanup.

Usage of a wetting unit, or equivalent, was based on 2.25 minutes per use.

(4) Washer/dryer penalty was based on washer concept 8, Water Spray Agitation

and Dryer concept 1, Forced Hot Air - Electric Dryer.

(5) Water used for Space Station equipment cleaning was assumed to be recycled minus the water lost associated with the suspended solids. Shuttle water used is not recycled.

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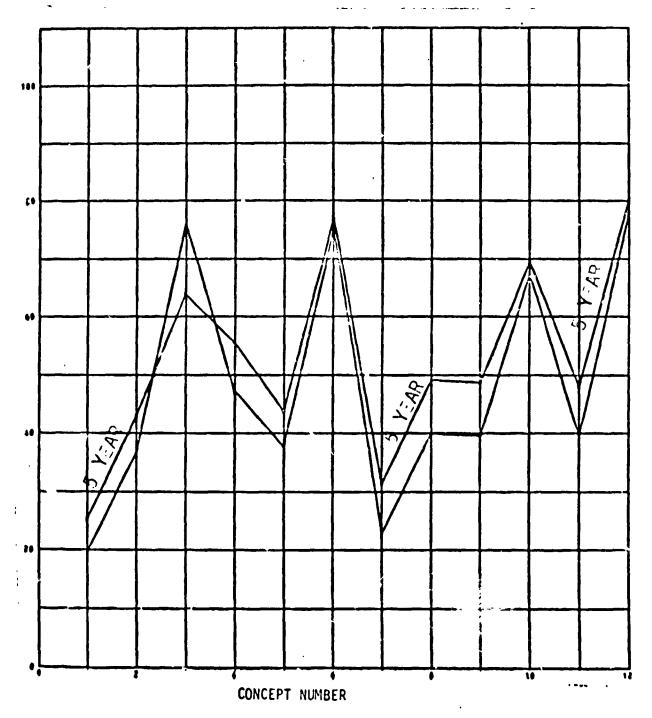
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APPITANCE
CONCEPT
NO. CONCEPT NAME

1 - DISPOSABLE RETADRY WIPES
2 - REUSABLE WET AIRES-DISPOSABLE DRY WIPES
3 - DISPOSABLE RETADRY WIPES (PREPACKAGED)
4 - AUTOMATIC SPONGE MOP
5 - REUSABLE CLEANING CLOTHS DISPOSABLE DRY WIPES
7 - DISPOSABLE CLEANING CLOTHS (SKLAB) DISPOSABLE DRY WIPES
7 - DISPOSABLE WET AIRES REUSABLE DRY WIPES
8 - HEUSABPLE WETADRY WIPES
9 - HEUSABPLE WETADRY WIPES
10 - DISPOSABLE CLEANING CLOTHS/DRY WIPES
11 - SPONGES/ENCLOSED WETTING UNIT
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Surfacing Wiping (Space Station) Concept Trade
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MATRIX • • • • SURFACE WIPING (  MAX	SELECTION MATRIX • • • • • SURFACE NIPING (	710N)	-	0 12.33 9.4	9.78 .0	5 8.17 .0	13.12 .9	3 1.47 .5	13.50 6.0	3 13.00 11.4	8 73.03 29.	88 76.87 31.3		RIOF .	POO	AII R (	PA( UA	GE LIT	KE
MATRIX • • • • • • SURFACE WIP  MAX  VALUE FTS, 1 2 3  774.10 15 6.80 10.86 • 9  155.50 15 00 00 15.  150.50 15 00 9.57 8.  1.0000 5 1.33 1.33 5.  50.000 15 6.00 6.00 12.  774.20 15 8.32 11.55 9.  95.000 10 25.19 42.94 63.	SELECTION MATRIX • • • • • SURFACE WIP  HIN MAX  VALUE VALUE PTS, 1 2 3  23.042 774.10 15 6.80 10.86 • • • • • • • • • SURFACE WIP  23.042 774.10 15 6.80 10.86 • • • • • • • • • • • • • • • • • • •		0 5 × C. E	0. 14+55 10	0 13.42	8 16.6 6	00.0	00.	9 00. 0	0 14.95 11	9 52.83 41	8 55.61 43							
MATRIX (02/01/75)  MAX (02/01/75)  MAX (774 - 10	#IN MAX (02/01/75)  #IN MAX (02/01/75)  ***********************************	<u>.</u>		10.86	•00 15•0	9.57 8.6	0.51 15.0	0.51	6.00 12.0	11.55 +0	40.79 60.6	42.94 63.							
HAX VALUE 774-10 355-00 150-50 150-50 000 774-20 95-000 0774-20 95	# IN		``∨	i	· 		İ	-	•	į		00 25.1							
		X X	MAX	774.10	355.00	193.30	150.50	00000	50.000	774.20	95.000	100.00							

SINGLE SLECTION PARAMETER WEIGHTING FACTOR BY 50 %  1 25.19 42.94 63.88 55.41 43.88 75.26 33.70 52.19 51.26 45.05 33.70 52.19 51.28 45.05				75 69.42 48.07 80.48	72 69.74 51.03 81.	18 69+11 44+55 79+3	03 70	75 68.19 47.10 79.1	18 68:49 47:52 79:2	11 70.92 47.48 81.1	32 70.29 51.30 81.			) 전환 (전환	100	OR.	UQ	GE ALL	四四 21 11 01 4	.75 69.42 48.07 80.48	.26 69.04 44.61 79.8	.92 69.78 52.19 81.79 .21 48.72 44.32 79.46	.37 70.77 51.64 79.8	.79 70.50 49.10 81.8	+34 70+40 48+65 81+7	-50 67-65 48-76 79-6
SINGLE SELECTION PARAHETER WEIGHTING FACTOR BY SC (BASED ON 100 % MAX POINTS)  26.66 45.07 57.26 33.70  23.35 39.77 66.52 58.61 43.88 77.26 33.70  23.35 42.52 66.51 58.64 45.89 77.26 33.70  23.58 42.50 66.52 58.07 40.67 77.11 29.84  25.23 42.52 66.51 54.19 43.89 77.26 30.84  25.23 42.52 66.51 54.19 43.89 77.26 30.84  25.23 42.52 66.51 54.19 43.89 77.26 30.84  25.23 42.52 66.51 54.19 43.89 77.11 29.84  25.24 42.94 59.21 58.84 46.26 77.59 34.69  27.41 45.43 59.21 58.84 46.26 77.59 34.69  27.41 45.43 59.21 58.84 46.26 77.59 34.69  25.29 40.41 69.36 55.61 43.88 76.87 31.38  25.19 42.94 63.88 55.61 43.88 76.87 31.38  25.19 42.94 63.88 55.61 43.88 76.87 31.38  25.19 42.94 63.88 55.61 43.88 76.87 33.38  25.19 42.94 63.88 55.61 43.89 76.87 33.38  25.19 42.94 63.88 55.61 43.88 76.87 33.38  25.19 42.94 63.88 55.61 43.89 76.87 33.38  25.19 42.94 63.88 55.61 43.89 76.87 33.38  25.19 42.94 63.88 55.61 43.89 76.87 33.38  25.19 42.94 63.88 55.61 43.89 76.87 33.38  25.19 42.94 63.88 55.61 43.89 76.87 33.38  25.10 43.82 62.80 57.12 44.21 75.75 30.84			•	4.16 48.	2 19 51 .	5.56 . 45.	1.50 51.		8 · 5 8 · 18 ·	8 48	2.74 52.									8+ 91.6	5.62 45	3.38 52	7.67 57	0.22 49	9.77 49	6.95 49
SINGLE SELECTION PARAMETER WEIGHTING FAC (BASED ON 100 & HAX POINTS)  1	11 NG Y		^	1 • 38	3 • 7	9.0	60.0	. c	1 • 2	2 .0	4			†		SING	n - D		~		28.6	0.4.0	1.00	31.9	31.5	30.6
SINGLE SELECTION PARAMETER WE (BASED ON 100 % HAX (BASED ON 100 %	I INCREA 46 FACTO		•	6 • 8	7.2	76.02	77.11	77.65	75.75	77.83	7.5			· · · · · · · · · · · · · · · · · · ·	:	2.5	•	!		76.8	76.4	77.8	76.0	78.1	78.0	75.7
SINGLE SELECTION P (BASED OF (BASED OF (BASED OF 25.19 42.94 63.0 23.93 39.79 66.0 23.93 42.52 65.0 23.93 42.52 65.0 24.02 42.52 65.0 25.23 42.52 65.0 25.19 42.94 63.0 25.19 42.94 63.0 25.19 42.94 63.0 25.50 45.02 60.0 25.50 45.02 60.0 25.50 45.02 60.0 25.50 45.02 60.0 25.50 45.02 60.0	T AFTER	e. w	so.	43.A	5.8	40.	46.1		 	43.5	46.2		:	;	n	PT AFTE	AK POIN	•	ر ب 5	43.8	5 • 1 • 5	2 47.6	7 ( ~ ! 7 :	) - • 7 7	43.9	44.2
SINGLE SELECTION P (8ASED OF (8ASED OF (8ASED OF 26.66 45.09 59.2 23.93 39.79 66.2 23.93 42.52 65.2 23.93 42.52 65.2 24.20 42.70 64.2 25.23 42.52 65.2 27.41 45.43 59.2 27.41 45.43 59.2 27.41 45.43 59.2 27.41 45.43 66.2 27.41 45.43 69.81 69.2 23.94 40.94 63.2 25.19 42.94 63.2 25.10 42.94 63.2	METER 1	. o		5 . 6	58.6	58.0	57.7	51.5	54.0			,				H CONCE	100 S H	; '	•	55.6	52.0	52.7	53.2	5.7.5	57.1	6003
SINGLE SELECTI (BAS) 25.19 42.94 26.66 45.09 23.93 42.94 23.93 42.94 23.93 42.97 23.93 42.97 23.93 42.97 24.80 42.10 25.23 42.52 24.80 42.94 27.41 45.43 27.43 40.41 27.35 46.62 26.60 46.00 25.59 40.00 26.60 46.00 25.59 40.00 26.60 46.00 25.59 40.00		,	3	3.8	•	9	45	9	<b>7</b> 3	0 C				:	SEN31-1	W (	. 0			63	6.64	•	•	•	0 40	42.5
SINGLE 25.01 23.03 23.03 23.03 23.03 25.23 25.23 25.23 25.23 25.23 25.23 27.33	SELECT!		7	2.9	5 • 0	9.7	5 . 5	0.2	7.					1		-	SELECT (BA!			2		•	0.0	9 0	7	, -
	INGLE		-	5 . 1	9.9		•	3.8		205						*	INGLE		<del>-</del>	25.		7	ŝ.	8 1	: :	- •

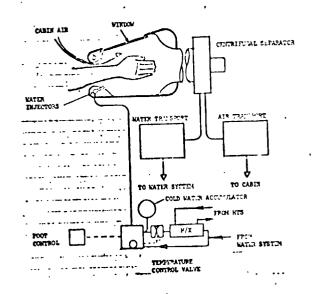
APPLIANCE CONCEPT COMPONENT SUMMARY MATRIX

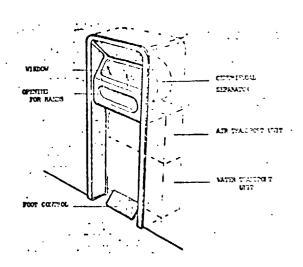
APPLIANCE FUNCTION: 3.1.1-EQUIPMENT CLEANING

CRITICAL NUMBER SAFETY ITEMS P SWITCH SWITCH 6 **ROTOM** S VALVE VALVE z LL! **ЯЗТА**ЗН z 0 MANUAL ۵ S S S Σ 0 **4MU**4 ပ CHECK Ľ. TIMER CONTROLLER 0 TEMPERATURE CONTROL VALVE  $\alpha$ ш ω **ACCUMULATOR** Σ  $\Rightarrow$ EXCHANGER z SOLENOID ~ 2 ~ ~ FILTER (D) ~ ~ 0 N **МАТЕВ** ЗЕРАВ**АТО**В ଡ COMPONENT TYPE SPONGES/SKYLAB TYPE WETTING UNIT AUTOMATIC SPONGE MOP (ASTRO-VAC) REUSABLE WET WIPES/DISPOSABLE WET WIPES DISPOSABLE WET WIPES/REUSABLE DRY WIPES SPONGES/ENCLOSED WETTING UNIT REUSABLE WET WIPES/REUSABLE DRY WIPES DISPOSABLE CLEAWING CLOTHS/ DISPOSABLE DRY WIPES DISPOSABLE CLEAWING CLOTHS/ REUSABLE DRY WIPES REUSABLE CLEANING CLOTHS/ REUSABLE DRY WIPES REUSABLE CLEANING CLOTHS/ DISPOSABLE DRY WIPES DISPOSABLE WET/DRY WIPES DISPOSABLE WET/DRY WIPES APPLIANCE TYPE

SPACECRAFT	Space Station	<del>-</del>
HABITABILI	TY SUBSYSTEM Housekeeping	HABITABILITY FUNCTION <u>Equipment Cleaning</u>
APPLIANCE	FUNCTION Surface Wiping	
APPLIANCE	CONCEPTO./TITLE 1/Disposable	e Wet/Dry Wipes
INDEX NO.		REF. NO. 236,186

DESCRIPTION The disposable wet/dry wipe concept utilizes a wet wipe for cleanup and dry wipe to soak up remaining moisture. A wetting unit with hand holes is
supplied for the function. The wetting unit has a water supply outlet and a fan
for providing water entrainment during use. A centrifugal separator is provided
upstream of the blower to collect used water. Water temperature is controlled
by mixing hot with cold water in a temperature controlled mixing valve. The crewman wets the wipe, uses it for area cleanup (disinfectant soap is located at the
wetting unit) and can be rewetted if necessary for cleanup. The wipe is wrung out
in the wetting unit and disposed of by deposit into a vacuum drier to remove excess
water. Dry wipe's are provided to dry damp areas left by the wet wipe. The used
wipes are deposited into the refuse system. The disposable wipes are 12 inch
squares of 4 ply "wet strength" paper. One wet wipe and one dry wipe are provided
per cleanup based on a maximum of 15 cleanup functions per day.





# APPLIANCE CONCEPT REQUIREMENTS AND PENALTIES CALCULATIONS CONCEPT // DISPOSABLE WET/URY WIPES

INDEX NUMBER 3.444

ELECTRICAL	POWER	REQUIRE	MENIS

		A	C PONE	R		C POWE	R
COMPONENT (REF)	USE TIME CYCLE (HR)	② PEAK (WATTS)	③ AVERAGE (WATTS)	OEMAND (WATT-HR/ CYCLE) ① X ③	(5) PEAK (WATTS)	6 AVERAGE (WATTS)	DEMAND (WATT-HR/ CYCLE) ① X ⑦
WETTING UNT (236)	_0375	500	360	13.5	,		
****					<del></del>		•
			<del></del>		•		
•						***************************************	
				•			
		•	•			•	
		500 . MAXIMUM	•	13.5 TOTAL	MUMIXAM	•	. TOTAL

#### THERMAL REQUIREMENTS

SOURCE	LATENT	SENSIBLE	HEAT LEAK	TO COOLANT
	(BTU/HR)	(BTU/HR)	(BTU/HR)	(BTU/HR)
MOTORS	360	918	948	360
TOTAL	105.6 (360)	Z <i>78 (949)</i>	278 (949)	105.6 (360)
	WATT (BTU/HR)	WATT (BTU/HR)	NATT (BTU/HR)	WATT (BTU/HP)

### OPERATIONAL PENALTIES

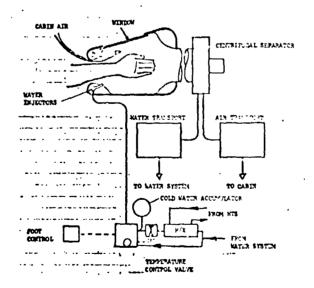
	•	,			•	•
1,	SOURCE	HEAT LEAK (BTU/HR/CYCLE)	RMAL TO COOLANT (BTU/HR/CYCLE)	ELECTRICAL (PK WATTS/CYCLE)	WEIGHT (LB/MISSION)	VOLUME (FT <sup>3</sup> /HISSION)
	-N/A-				•	
		•				
	<del></del>					
<b>'</b> }	· · · · · · · · · · · · · · · · · · ·		, <del></del>		<del></del>	•
	<del></del>			<del></del>		
•	TO	MATTS/CYCLE (BTU/HR/CYCLE)	WATTS/CYCLE (BTU/HR/CYCLE)		KG/MISSION (LB/MISSION)	MY/MISSION (FT'/MISSION)

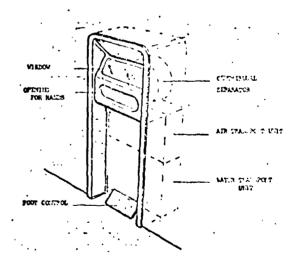
# APPLIANCE CONCEPT REQUIREMENTS AND PENALTIES CALCULATIONS (CONCLUDED) CONCEPT 1/DISPOSABLE WET/URY WIPLS INDEX NUMBER 3.1.1.1

OMPONENT WETTING UNIT WETTWEY WIPES	·(REF) (236) (236)	WEIGHT (LBS) 76.69 828		VOLUME (FT <sup>3</sup> ) 185.0 8.28
	TOTAL	72.34 (15)	9.5)]	5.47 <i>(193.3</i> )
	•	KG (LBS)		M <sup>3</sup> (FT <sup>3</sup> )
TYPE UNITS/OUET WIPES 1	MT/UN	(B L E W 1/V O L  (C) (C) (C) (C) (C) (C) (C) (C) (C) (C	REQUIREMENTS  (PEF (PKG. VOL / UNIT) (FT3)	(5) YOL/CYCLE
OTAL WT	x 184 DAYS/MISSI	∑③030 TOTAL WT/C (LB) x .030		(F13)  37.56 (BZB)
CYCLES/DAY  OTAL VOL  MISSION "	DAYS/MISSI x	ON TOT. WIT. YELE (LB)  N TOT. VOL. / CYCLT		KG (LB)  234 (8.28)
TYPE DXYG = N LWP: DISPON WATER WATER LOSS (WEFWIPE) WATER (OSS (WEFWIPE)	MT.USED/CYCLE (REF (LB) (LB) .:000719 	© Dreament	EQUIREMENTS  AMT.RECOVERED/CYCLE  ① X ② (LB)  . N/A  1995  N/A  N/A  N/A	AMT LOST/CYCLE ()-(3) (LE) -000719 -0005 -0454 -0490
ΣΦ	.59 <b>\$</b> 1		$\sum (\tilde{a})$	.0956

SPACECRAFT	Space Sia	tion				
HABITABILI	TY SUBSYSTE	M Housek	eeping	_HABITABILIT	Y FUNCTION <u>Equipment Cla</u>	<u>eani</u> ng
APPLIANCE	FUNCTION	Surface	Wiping			<del></del>
APPLIANCE	CONCEPT NO.	/TITLE_	2/Reusable	Wet/Disposab	le Dry Wipes	
INDEX NO.	3.1.1.2		_	REF. NO	236,186	

DESCRIPTION The reusable wet/disposable dry wipe concept utilizes a wet reusable wipe for cleanup and a disposable dry wipe to soak up remaining moisture. The wetting unit described in concept 1 is also required for this concept. The reusable wipes, however, are wrung out in the wetting unit and reused. Three reusable wipes are provided for a maximum 15 cleanups per day. The wipe is used a maximum of 5 times before washing. After sixty washings, the wipe is discarded and replaced. The reusable wipes are 10 inches square of 4 ply "wet strength" paper. The disposable dry wipes are 12 inch squares of 4 ply "wet strength" paper. One dry wipe per cleanup are provisioned which are disposed of by deposit into a vacuum drier to remove excess water. The dry wipes are provided to dry damp areas left by the wet wipe.





# APPLIANCE CONCEPT REQUIREMENTS AND PENALTIES CALCULATIONS CONCEPT 2/REUSABLE WET/DISPOSIBLE DEY WIPES

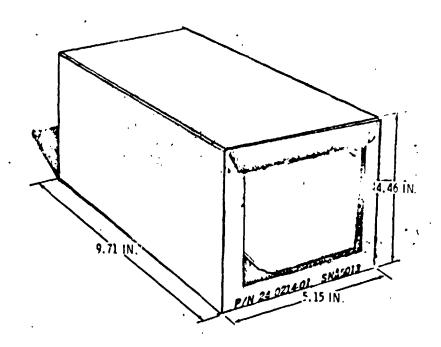
INDEX NUMBER 3.1.1.2

	USE TIME		A C . POI	7	D C	POWER
•	CYCLE	② PEAK	3 AVERAGE	DEMÁND (WATT-HR/	(5) PEAK A	6 DEMAND PERAGE (WATT-HR
COMPONENT (REF)	(HR)	(WATTS)	(WATTS)	OX3	(STTAW)	ATTS) CYCLE)
WETTING UNIT (236)	.0375	500	360	_13.5		
				18 6	<del></del>	•
•		500 MAXIMUM		13.5	MAXIMUM	TOTAL
•						,
	•					
SOURCE		LATENT (BTU/HR)		ENSIBLE (BTU/HR)	HEAT LEAK (BTU/HR)	TO COOLANT (BTU/HR)
WATER YEAT LOS	_	360			-	360
MOTORS	<u></u> -			948	948	
	<del></del> -			<del></del>		***
		/	·			INC / IX/
1		05.6 (3)			278 (948)	
1		105.6 (3) WATT (BTU/H		7 <i>8 (948)</i> t (btu/hr)	WATT (BTU/HR)	WATT (BTU/HP)
1					, ,	
1					, ,	
1		WATT (BTU/H	IR) WAT	T (BTU/HR)	, ,	
1			IR) WAT	T (BTU/HR)	WATT (BTU/HR)	
SOURCE		PERATI THER	IR) WAT	T (BTU/HR)  PENALTIES  ELECTRICAL	WATT (BTU/HR)	
SOURCE WASHER	<u>O</u> HEAT (BTU/HR/	PERATI  THERM LEAK CYCLE)	IR) WAT	T (BTU/HR)  E N A L I I E S  ELECTRICAL (PK WATTS/CYC	WATT (BTU/HR)  WEIGHT CLE) (LB/MISSION)	WATT (BTU/HP)
	<u>O</u> HEAT (BTU/HR/	PERATI  THER- LEAK CYCLE)	IR) WAT	T (BTU/HR)  PENALTIES  ELECTRICAL  (PK WATTS/CYC	WATT (BTU/HR)  WEIGHT  CLE) (LB/MISSION)	WATT (BTU/HP) VOLUME
SOURCE WASHERE	<u>O</u> HEAT (BTU/HR/	PERATI  THERM LEAK CYCLE)	IR) WAT	T (BTU/HR)  E N A L I I E S  ELECTRICAL (PK WATTS/CYC	WATT (BTU/HR)  WEIGHT CLE) (LB/MISSION)	WATT (BTU/HP)
SOURCE WASHERE	<u>O</u> HEAT (BTU/HR/	PERATI  THERM LEAK CYCLE)	IR) WAT	T (BTU/HR)  E N A L I I E S  ELECTRICAL (PK WATTS/CYC	WATT (BTU/HR)  WEIGHT CLE) (LB/MISSION)	WATT (BTU/HP)
SOURCE WASHER	0 HEAT (BTU/HR/I	PERATI  THERM LEAK CYCLE)	IR) WAT	T (BTU/HR)  E N A L I I E S  ELECTRICAL (PK WATTS/CYC	WATT (BTU/HR)  WEIGHT CLE) (LB/MISSION)	WATT (BTU/HP)

APPL CONCEPT 2/REUSABLE WE		ENTS AND PENALTIES CALCULI EY WIPES		BER 3.1.1.2
COMPONENT WEITING UNIT WEI / WISP SABLE DRY	·(REF) 	VOLUME REQU.:  WEIGHT (LBS)  28.49 41.5	I REMENTS	VOLUME (F1 <sup>3</sup> ) 3.5 4.27
	TOTAL	31.75 (999 KG (LBS)		220 (7.77) N <sup>3</sup> (FT <sup>3</sup> )
TYPE UNITS/C	D EXPENDAB  (C)  (D)  (PKG. WT/UNIT)  (PKG. WT/UNIT)  (LB)  (C)  (C)  (C)  (C)  (C)  (C)  (C)  (	) ③ (REF) WT/CYCLE IT)(REF) ① X ② ). (LB)	QUIREMENTS  (4)  VOL/UNIT (HEF)  (PKG. VOL/UNIT)(RE  (FT3)  3	(FT3)
TOTAL WT 15 WISSION CYCLES/DAY	x B4	∑③ •0/5668 101AL NT/CYCLE (LB) x •05068 101.WT/CYCLE (LB)	· [/8.8	TOTAL VOL/CYCLE  (FT3)
,	DAYS/MISSION  LIQUID EXP   AMT.USED/CYCLE(REF)	② . RECOVERY	UIREMENIS  ONT. RECOVEHED/CYCLE  OX	AMT LOST/CYCLE
WATER WASHON WATER LOSS PENALTY	.5 (236)	1-,0009	.11989	.00011

SPACECRAFT Space Station	<del></del>
HABITABILITY SUBSYSTEM Housekeeping	HABITABILITY FUNCTION Equipment Cleaning
APPLIANCE FUNCTION Surface Wiping	
APPLIANCE CONCEPT NO./TITLE 3/Disposal	ole Wet/Dry Wipes (Prepackaged)
INDEX NO. 3.1.1.3	REF. NO.250,283

DESCRIPTION The disposable wet/dry wipes concept consists of prepackaged wet wipes which were used on Skylab. The wet wipes are contained within a package to eliminate water evaporation during storage. The dry wipes are dispensed from a 196 count container. The wet and dry wipes are used for cleanup and discarded. The Skylab size wet wipe weight and volume were ratioed (5.3) to the 10 inch square wipes used in Concepts 1 and 2 in order to provide a equivalent trade.



Wipe Dispenser

APPLIANCE CONCEPT REQUIPEMENTS AND PENALTIES CALCULATIONS CONCEPT 3/DISPOSABLE WET/DRY WINES (PREPARENGED)

INDEX NUMBER 3.1, 1.3

•			AC PO	WER		DL	POWE	R
	USE TIME	② PEAK	(1) AVE RAGI	Tr E <sup>(N)</sup>		(3) PEAK	6 AVERAGE	(7) DEMAND (WATT-HR
COMPONENT REF.	(HR)	(WATTS)	(WATTS	) .	, (W	IATTS)	(WATTS)	CYCLE)
N/A				A				
						<del></del>		
	*** ****			٠		<del></del>		
	er to make the	* · · · · · · · · · · · · · · · · · · ·	-mark tope is					
					·			
•		MAXIMUM	<del></del>	TOT/	AL MA	XIMUM		TOTAL
		IHERMA	L REQU	<u>LIPEMEN</u>	<u> </u>			
SOURCE		LATENT (BTU/HR)		SENSIBLE (BTU/HR)		EAT LEAK BiJ/HR)		COOLANT ITU/HR)
N/A		-	<del></del>				-	
				·				
			<del></del>	·	<del></del> -			
	·							
	TOTAL							
		WATT (BTU/H	IR) WA	TT (BTU/HR)	WATI	T (dTU/HR)	WATT	(BTI./HR)
•								
•			•					
		•						
	į	<u>OPERATI</u>	OHYF	PENALI	ĪĒŠ			
•	MEA	THERM T LEAK	IAL	ELECT	RICAL	WE 1GHT	٧	OLUME
SOURCE		/CYCLE)	TO COOLANT (BTU/HR/CYCLE		TS/CYCLE)	(LB/MISSI		/MISSION)
N/A		-		·	<del></del> -	·		
					<del></del> -			
		<del></del>	•					

C2-368

KG/MISSION (LB/MISSION) MYMISSION (FTYMISSION)

WATTS/LYCLE / (BTU/HR/CYCLE)

TOTAL

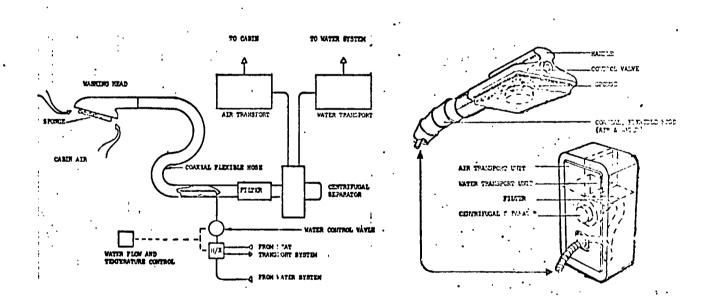
WATTS/CYCLE (BTU/HR/CYCLE)

# APPLIANCE CONCEPT REQUIREMENTS AND PENALTIES CALCULATIONS (CONCLUDED) CONCEPT 3/DISTOSABLE WITTORY WIPES (PREPACKAGED) INDEX NUMBER 3.1.1.3

	41		WEIGHT			VOLUME
COMPONENT WIFE	(REF) 5 • (32,	(SO)	(LBS) 774.	2		(ft³) 25.39
			-			
		_				
		·				
		-	·			<del></del>
					•	
	TOTAL	_	351.1 (	774.2)	7	18 /2 (20)
	. TOTAL	L	. KG (LBS)	117.6)	<u> </u>	18 (25.39)
		·	(200)			
· <u>\$ 0</u>	LID EXP	ENDAB		<u>R E Q U</u> 3	IREMENTS (A)	(5)
	0	WT/UNIT	(PEF) WT/(	CYCLE	VOL/UNIT (PEF) (PKG.VOL/UNIT)(PEF	VOL/CYTLE ) () x '4) (FT')
TYPE UN WET WIPES	ITS/CYCLE(REF)	(LB	) 1(6.3) (No.(m.)	18) 12	.1c1/301(6.3)(1)	(FT')
BIOCIDE WIPES			76.31(20)_15.3		129/72(6.3) (2	
DKY WIPES			72.0) .010		129/196 10	
			·			
						· · · · · · · · · · · · · · · · · · ·
			Σ① .23	25	Σ હ	0092
			TOTAL	05 117(10[E - 18)	. 20	101AL VUL CYLLE (FT)
TOTAL WT	X A	184 45/MISSIUN	. x 286_	.5	35	7.2 (774.2)
CYCLES/D	AY DA	<b>งรั/ห</b> รีรราบจ	TOT.WT/C	ici e	,	KG (LB)
TOTAL VOL - /S	x ,	184	1 .009	9z •	1 .7	18 (11) (25.39)
CYCLES/D	AY DĀ	184 85/41221011	101.VUL70	YCLE"	*	्र भारत्ये हा
•						
ē	A 5/L 1 Q U 1 D	E X P	ENDABLES	REQUI	ŖĘ M EN Ţ Ş	
		D	Ø RECOVERY	AMT.R	ECOALPED/CATTE	AMT LOST/CYCLE
TYPE	AMT.USED/C (L	YCLE(REF) B)	FACTOR		(FR)	(LB)
N/A	<del></del>			<del></del>		
. Σ	<u> </u>		•		$\Sigma$ $\odot$	
TOTAL NY.			•			<u></u>
MISSION" CYCLE/DAY	— X —BAVS/HIS	STUN TO	YALTIOSY/CYCLE	((8)	·	L KG (LB)

SPACECRAFT Space	e Station		
HABITABILITY SU	BSYSTEM Housekeeping	_HABITABILI	TY FUNCTION Equipment Cleaning
APPLIANCE FUNCT	ION Surface Wiping	<del></del>	
APPLIANCE CONCE	PT NO./TITLE 4/Automatic	Мор	
INDEX NO. 3.	1.1.4	REF. NO.	236,100

DESCRIPTION The automatic mop concept is a hand held scrubber head connected by coaxial flex tubing to a water supply valve and an air transport system. Water is fed into a sponge in the scrubber head for use in cleaning equipment. A water pick up housing connected to the vacuum line surrounds the sponge. A water separator is used to collect water from the cabin air. A pump unit injects water into the water waste management system. One new sponge is provided per week.



APPLIANCE CONCEPT REQUIREMENTS AND PENALTIES CALCULATIONS CONCEPT 4/AUTOMATIC MOP

INDEX NUMBER 3.1.1.4

	ELECI	RICAL	<u>POWER</u>	REQUIR	EMENIS D	C POWER	
. COMPONENT (REI)	USE YIME CYCLE (HR)	② PEAK (WATTS)	(WATTS)	DEMAND (WATT-HR/ CYCLE) ① X ③	⑤ PEAK (WATTS)	6 DE AVERAGE (WAT	(7) MAND T-HR, LE) X (7)
AUTOWATIC MCPUNIT (236)	.0375	52.8	31.7	1.19			
		52.8. MAXIMUM	•		MAXIMUM		TAL
`,	•				,		
		THERMAL.	REQUI	REMENIS			
SOURCE		LATENȚ (BTU/HR)		SIBLE U/HR)	HEAT LEAK (BTU/HR)	TO COOLANT (BTU/HR)	T
WATER HEAT LO MOTORS	<u> </u>	2700		76.7	36,7		2
	TOTAL	791 (270) WATT (BTU/HR)		3 <i>(36,</i> 7) (BTU/HR)	10.8 (36. WATT (BTU/HR		
•							
	<u>o</u>	<u> </u>	NAL PE	. <u>N A L T I E</u> S	<u>.</u>		
SOURCE	, HEAT (BTU/HR/	THERMAL LEAK 1 CYCLE) (B'	TO COOLANT TU/HR/CYCLE)	ELECTRICAL			) NC
N/Et		· -	•.		·		<del></del> ~
				•			
·	TAL	-	• 	-			
	HATTS	R/CYCLE   R/CYCLE) (E	ATTS/CYCLE BTU/HR/CYCLE)		KG/MISSI (LB/MISSI		

APPLIANCE CONCEPT REQUIREMENTS AND PENALTIES LA CULATIONS (CONCLUDED)

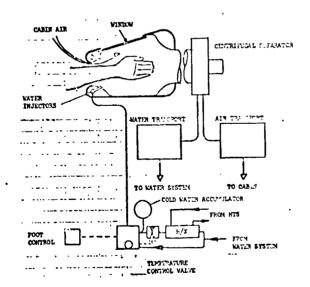
CONCEPT 4/ NUTO MINIC MOP

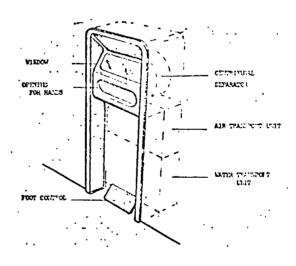
INDEX NUMBER 3. 1.1.4

OMPONENT	(REF)		WEIGHT (LBS)			VOLUME (FT³)
AUTOMATIC MOP			20.	6		1.5
SPONGLS		<del></del>		18		
		<del></del>	· <del></del>	<del></del>		
					<del></del>	
					-	
	TOTAL	. [	9.88	(21.78)	<u></u>	048 (1.7)
		•	KG (LBS		L	M <sup>3</sup> (FT <sup>3</sup> )
,			5 T.W.O.			•
, 3	<u>O L 1 D</u> <u>E X P E</u>	NDABL ②		3	IREMENTS VOL/UNIT (PEF	
TV05	(D)	- WT/UNIT (R PKG.WT/UNIT	EF) W )(REF) (	T/CŸCLE Dx@ (LB)	(PKG.VOL/UNIT)(	) VOL/CYCLE REF) (1) X (4) (FT <sup>3</sup> )
TYPE L SPONGES	NITS/CYCLE(REF) -143 (236)	(LB) •00298	9 (236) .00	(LB) >>> <i>4</i> -27	(FT <sup>3</sup> ) 000481	
	-					
	-					
	-					
			Σ3 .00	20427	7	· 000069
			TOTAL	0427 L WI/CYCLE (LB)	4	(FT.)
OTAL WT. TISSION TO 15	v /	R 4	x .000	0427 *		
CYCLES/	DAY A DAYS	8 <i>4</i> /mission	TOT.WT. (LI	/CYCLE		KG (LB)
TAL VOL		24			Γ/	2054 [19]
MISSION CYCLES/	DAY A DAYS	WIZZION	_ X <i>OOC</i> 101. <b>V</b> 01	LYCYCLE	L	0054 (.19) M <sup>3</sup> (FT <sup>3</sup> )
•		,	(1)	13)		
	<u>G A S/L 1 Q U I D</u>	EXPE	N D A B L E S	REQUI	REMENTS	•
, ,	<b>①</b>		0		<b>③</b>	<b>(</b>
	AMT.USED/CYC	LE(REF)	RECOVERY	AMT.	RECOVERED/CYCLE  OXO	AMT LOST/CYCLE
TYPE VATER	(L8) کورت '	(236)	FACTOR /000	9.	49955	·00045
~				<del></del>	Γ.	
. 2	<u> </u>		•		20	00045

SPACECRAFT Space Station	·
HABITABILITY SUBSYSTEM Housekeeping	HABITABILITY FUNCTION Equipment Cleaning
APPLIANCE FUNCTION Surface Wiping	
APPLIANCE CONCEPT NO./TITLE 5/Reusable	e Cleaning Cloths/Disposable Dry Wipes
INDEX NO. 3.1.1.5	REF. NO. 236,237,245,209

DESCRIPTION The reusable cleaning cloth/disposable dry wipe concept is the same as Concept 2; however, terry cloth are used for cleansing cloths. The terry wash clothes are 6 inches square. The cleaning cloths are provisioned 3 per day for a maximum of 5 clean up functions. The cleaning cloth is used for sixty washings then is discarded and replaced. The cleaning cloth is washed and dried daily using a washing machine and dryer. The disposable dry wipes are 12 inch squares of 4 ply "wet strength" paper. Once disposable dry wipe is provided per clean up based on a maximum of 15 cleanup functions per day. The wipes are disposed of by deposit in the refuse system. The concept is penalized for theusage of a wash/dryer for recycling the terry cloth cleaning cloths.





# APPLIANCE CONCEPT REQUIPEMENTS AND PENALTIES CALCULATIONS CONCEPT 5/REUSIBLE CLEANING CLOTHS/DISPOSABLE DRY WIPES INDEX NUMBER 3.1.1.5

### ELECTRICAL POWER REQUIREMENTS

	•	A (	C . POWE		0 (	POWE	R
COMPONENT (REF)	USE TIME CYCLE (HR)	② PEAK (WATTS)	③ AVERAGE (WATTS)	(4) DEMAND (WATT-HR/ CYCLF) ① X ③	⑤ PEAK (WATTS)	⑥ AVERAGE (WATTS)	(')     DEMAN' (WATT-H / CYCLE) (1) X (7)
WETTING UNIT (23)	.0375	500	361	13.5			
							·
• •				•			
			•		مسيسيدها الودي بالمسيدة فسي	•	
٠.		500 . MAXIMUM		<u>パラス</u> TOTAL	MUMIXAM		. TOTAL

### THERMAL REQUIREMENTS

, SOURCE		LATENT (BTU/HR)	SENSIBLE (BTU/HR)	HEAT LEAK (BTU/HR)	TO COOLANT (BTU/HR)
WATER HE	AF LOSS	360	948	948	360
\	TOTAL	105.6 (360) NATT (BTU/HR)	278 (948) WATT (BTU/HR)	278 (948) WATT (BTU/HR)	105.6(360) WATT (BTU/HP)

#### OPERALLONAL PENALLIES

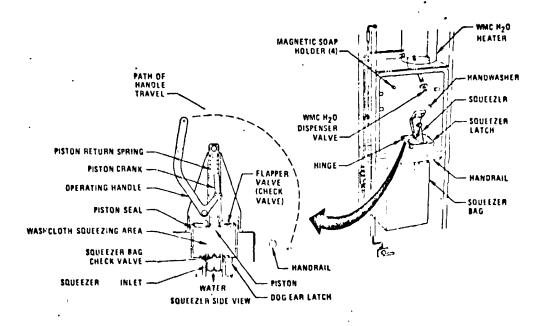
<i>I</i> .,	SOURCE	HEAT LEAK (BTU/HR/CYCLE)	RMAL TO COOLANT (BTU/HR/CYCLE)	ELECTRICAL (PK WATTS/CYCLE)	MEIGHT (LB/MISSION)	VOLUME (FT³/MISSION)
WA. DRY	SHEK IER		22.9		6.8 2.7	.60
<u>'</u>		53.7	6.7		4.3	.034
•	NTOT	NATTS/CYCLE)	(22,9) WATTS/CYCLE (BTU/HR/CYCLE)	18.0	(9,5) KG/MISSION (LE/MISSION)	(1.21) 11'/H15510N (FT'/H15510N)

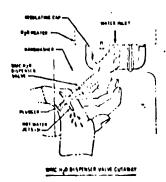
#### APPLIANCE CONCEPT REQUIREMENTS AND PENALTIES CALCULATIONS (CONCLUDED) CONCEPT 5/RLUSABLE CLUANING CLOTHS/DISPOSABLE DRY WIPLS INDEX NUMBER 3.1.1.5

TOTAL	#ONOONENT	(nes)	WEIGHT		VOLUME
TOTAL 33.3 (73.96)	COMPONENT	(REF)	(LBS)		(FT <sup>3</sup> )
TOTAL 33.3 (73.78)		(436)			
TOTAL 33.3 (73.96) .287 (10.7.1  \$0.110 EXPENDABLE NIV.0.1 REQUIREMENTS  \$0.110 EXPENDABLE NIV.0.1 REQUIREMENTS  \$0.110 EXPENDABLE NIV.0.1 REQUIREMENTS  \$0.100 (PRC.NT/UNIT)(RET)		(236)	44.99		6.65
TOTAL 33.3 (73.48)  SOLID ELPENDANIE HIVE L REQUIREMENTS  WITHOUT CHEFT OF THE WITHOUT CHEFT OF THE WOLLOW THE WOLLD					
SOLID   EXPENDABLE   HJ/YOL   REQUIREMENTS					
SOLID   EXPENDABLE   HJ/YOL   REQUIREMENTS					
SOLID   EXPENDABLE   HJ/YOL   REQUIREMENTS		<del></del>	·		
SOLID   EXPENDABLE   HJ/YOL   REQUIREMENTS					
SOLID   EXPENDABLE   HJ/YOL   REQUIREMENTS					
SOLID   EXPENDABLE   HJ/YOL   REQUIREMENTS			~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~		
SOLID EXPENDABLE HIVE   REQUIREMENTS   WITCHE   WOLVENT   (REF)   WOLVENT   WOLV		TOTAL .	33.3 (73.	48)	.287 (10.15)
WIT/UNIT   PEF   WIT/CYCLE   PYG. WIT/UNIT   PEF   WIT/CYCLE   PYG. WIT/UNIT   PEF   WIT/CYCLE   PYG. WIT/UNIT   PYG. WIT/UN		•	• KG (LBS)		M3 (FT3)
WIT/UNIT   PEF   WIT/CYCLE   PYG. WIT/UNIT   PEF   WIT/CYCLE   PYG. WIT/UNIT   PEF   WIT/CYCLE   PYG. WIT/UNIT   PYG. WIT/UN					•
TYPE UNITS/CYCLE (REF) (REG. M/CMIT) (REF) (LB) (REG. MOLIMIT) (REF) (REG. MOLIMIT) (REG. MOLIMIT) (REF) (REG. MOLIMIT) (REG. MOLIMIT) (REG. MOLIMIT) (REG. MOLIMIT) (REG. MOLIMIT) (REG. MOLIMIT)	<u>s o l 1</u>	<u>D EXPENDA</u>			- ' <u>-</u>
TYPE UNITS/CYCLE (PEF) (LB) (LB) (LB) (LB) (LB) (LB) (LB) (LB		WT/UNI	T (REF) WT/CYCLE	: VOL/UNIT (PE	F) VOL/CYCLE
DRY WIPES   (236) .077 .0013 .0546 (209) .00091	TYPE UNITS/				(REF) (1) X (4)
DIZY WIPES (236) .015 (237) .0015 (238) .0015  \[ \times \frac{1}{20} \cdot \frac{1}{20} 1					
TOTAL WT			5 (2:6) .015	0015	
TOTAL WT.  HISSION  JOHNS/MISSION  J					
TOTAL WT.  HISSION  JOHNS/MISSION  J					
TOTAL WT.  HISSION  JOHNS/MISSION  J					
TOTAL WT.  HISSION  JOHNS/MISSION  J					
TOTAL WT.  HISSION  JOHNS/MISSION  J			50		
TOTAL WT.  HISSION  JOHNS/MISSION  J		•	<b>と</b> ③ <u>*</u> のんづ TOTAL ht, LY	CLE .	5 (5) .0024 ( TUTAL VOL/CYCLE
THISSION			(LB)		(FT ')
TOTAL VOL	THISSION 3	_ x _ 184	× .0163	_ · [	20.41 (44.99)
TOTAL VOL.  MISSION    15	CYCLES/DAY	DAYS/MISSIC	N TOT.WT/CYCLE (LB)		KG (LB)
CYCLES/DAY DAYS/MISSION TOT. VOL/CYCLE  GAS/LIQUID EXPENDABLES REQUIREMENTS  O ANT. USED/CYCLE (REF) RECOVERY AMT. RECOVERD/CYCLE AMT LOST/CYCLE  TYPE (LB) FACTOR (LB)  WATER (S (236) 10009 .49955 .0009.5  WASHEK WATER (OSS PENALTY .125 10009 .12989 .0001.1  WATER LOSS (DRY WATER) .049 N/A N/A .049  OXYOLN (WIFE DISPOSA) .000719 N/A N/A .000719  DAYS/MISSION DAYS/MISSION TOTAL LOST/CYCLE .38.8 · .67472 .63.3 (39.8)	TOTAL VOL	104			700
GAS/LIQUID EXPENDABLES REQUIREMENTS  TYPE  ANT.USED/CYCLE(REF)  PACTOR  (LB)	MISSION	X <u>184</u> Days/missìò	X <u>, 002</u> 41		188 (6.65)
TYPE  ANT. USED/CYCLE (REF)  (LB)  FACTOR  (LB)  WATER  (LB)  WATER  LOSS PENALTY  125  WATER LOSS (DRY WATER)  OXYULN (WIFF DISPOSE)  NOO719  TOTAL HT.  WISSION  TOTAL HT.  WECOVERY  RECOVERY  ECOVERY  RECOVERY RECOVE	•	•	(FT3)		•
TYPE  ANT. USED/CYCLE (REF)  (LB)  FACTOR  (LB)  WATER  (LB)  WATER  LOSS PENALTY  125  WATER LOSS (DRY WATER)  OXYULN (WIFF DISPOSE)  NOO719  TOTAL HT.  WISSION  TOTAL HT.  WECOVERY  RECOVERY  ECOVERY  RECOVERY RECOVE			•		
TYPE  ANT. USED/CYCLE (REF)  FACTOR  (LB)  WATER  (LB)  FACTOR  (LB)  FACTOR  (LB)  FACTOR  (LB)  (LB)  FACTOR  (LB)  FACTOR  (LB)  (LB)  FACTOR  (LB)  (LB)  FACTOR  (LB)  (LB)  FACTOR  (LB)  FACTOR  (LB)  (LB)  FACTOR  (LB)  (LB)  (LB)  (LB)  (LB)  (LB)  FACTOR  (LB)  (LB)  (LB)  (LB)  FACTOR  (LB)  (LB)  (LB)  (LB)  FACTOR  (LB)  (L	<u> </u>	<u>/Liquid ex</u>	PENDABLES RE	QUIREMENTS	
TYPE  ANT. USED/CYCLE (REF)  FACTOR  (LB)  WATER  (LB)  FACTOR  (LB)  FACTOR  (LB)  FACTOR  (LB)  (LB)  FACTOR  (LB)  FACTOR  (LB)  (LB)  FACTOR  (LB)  (LB)  FACTOR  (LB)  (LB)  FACTOR  (LB)  FACTOR  (LB)  (LB)  FACTOR  (LB)  (LB)  (LB)  (LB)  (LB)  (LB)  FACTOR  (LB)  (LB)  (LB)  (LB)  FACTOR  (LB)  (LB)  (LB)  (LB)  FACTOR  (LB)  (L	. •	•	Ø	(3)	<b>(4)</b>
TYPE  WATER  S (236) 10009 .49955 .00095  WASHER WATER  LOSS PENALTY .125 10009 .12489 .00011  WATER LOSS (DRY WAS) .049 N/A N/A .049  OXYULN (WIPE DISPOSIN) .000719 N/A N/A .000719  \[ \text{TOTAL HT.}	•		DECOVEDA	AMT. RECOVERED/CYCLE	AMT_LOST/CYCLE
WASHER WATER LOSS PENALTY .125 10009 .12989 .00011 WATER LOSS (DRY WAS) .049 N/A N/A .049 OXYOLH (WIPE DISPOSE) .000719 N/A N/A .000719  \[ \sum_{\text{total HT.}} \sum_{\text{viction}} \sum_{\text{total HT.}} \sum_{\text{viction}} \sum_{\text{total HT.}} \sum_{\text{total HSSION}} \sum_{		(LB)	* FACTOR	(LB)	(18)
LOSS PENALTY .125 1-,0009 .12489 .00011 WATER LOSS (DRY WAS) .049 N/A N/A .049 OXYULN (WIP: DISPOSE) .000719 N/A N/A .000719  \[ \tag{\text{TOTAL HT.} = \frac{15}{45} \text{ x \ 184 \text{ x \ 0503 \ 1014L \1051/CYCLE} \text{ \frac{138.8}{138.8} \cdot \frac{63.3}{47472} \text{ \frac{163.3}{167.8} \text{ (18)}}			(a) <u>10009</u>	<u>.49955</u>	.00095
WATER LOSS (DRY WAS) .049 N/A N/A .049 OXYULN (WIPE DISPOSE) .000719 N/A N/A .000719  \[ \tilde{\text{DITAL WT.}} \tilde{\text{LOSS}} \tilde{\text{COSS}} \tilde{\text{LOSS}} \text		125	1- 0009	12400	
OXYOLN (WIPE DISPOSE) .000719 N/Λ N/Λ .000719  Σ ① .67472 Σ ② .0503  TOTAL WT 15 × 184 × .0503 · 138.8 · .67472 · .63.3 (39.			N/n	N/N	
Σ① .67472 Σ① .0503 TOTAL NT 15 x 184 x .0503 · 138.8 · .67472 · .63.3 (39. WILLIAM DAYS/MISSION TOTAL LOST/CYCLE		·	N/N	NIA	
TOTAL NT 15 x 184 x 0503 • 138.8 • 67472 • 63.3 (39.		, , , , , , , , , , , , , , , , , , , ,			
TOTAL NT 15 x 184 x 0503 • 138.8 • 67472 • 63.3 (39.	$\Sigma$ . $\Box$	.67472		5.0	0.0503
CYCLE/DAY DAYS/MISSION TOTAL LOST/CYCLE KG (LB)	. 20				
CYCLE/DAY DAYS/MISSION TOTAL LOST/CYCLE KG (LB)	TOTAL WT.	, IRA '.	0502 120	99. 6747:	- 63.3 (/394)
(x (d) (l b) (x (D)	CYCLE/DAY	DAVS/MISSION A	TOTAL LOST/CYCLE		

<b>SPACECRAF</b>	T Space Stat	ion	•		
HABİTABIL	ITY SUBSYSTE	M Housekeeping	HABITABIL	ITY FUNCTION_	Equipment Cleaning
APPLIANCE	FUNCTION	Surface Wiping			
APPLIANCE	CONCEPT NO.	/TITLE_6/Disposable	Cleaning	Coths/Disposa	ble Dry Wipes
INDEX NO.	3.1.1.6		REF. NO.	236,283	

DESCRIPTION The disposable cleaning cloths/disposable dry wipes concept is the system used on the Skylab applied to equipment cleaning. The terry cloth cleaning cloths are wetted by depressing a water supply valve. The unit will provide warm water from a heated storage tank. After the cloth is used, it is squeezed using a manual squeezer unit. The water squeezed from the cleaning cloth is assumed to be recovered and routed to the water waste management system. Three cleaning cloths are provided per day for a maximum of 15 cleanup functions. The cleaning cloths are disposed of by deposit into a vacuum dryer to remove excess water. The dried cloth is then deposited into the refuse system. The disposable vipes are 12 inch squares of 4 ply "wet strength" paper. One dry wipe is provided per cleanup based on a maximum of 15 cleanup functions per day. The used dry wipe is deposited into the refuse system.





C2-376

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# APPLIANCE CONCEPT PEQUIPEMENTS AND PENALTIES CALCULATIONS CONCEPT 6/0/5805881 - ELEMANAS CLOTUS 1005080 & DONALDOS INDEX NUMBER 3.1.1.6

USE TIME (2) (3) DEMAND (5) (6) DEMAND CYCLE PEAK AVERALE (WATT-HR) PEAK AVERALE (WATT-HR) COMPONENT (REF) (HR) (WATTS) (WATTS) (WATTS) (WATTS) (WATTS) (WATTS)  HENTEL (283) .0375 —					WER		EMENIS		- •
ST.S. ST.S ST.S ST.S ST.S ST.S ST.S ST.	OMPONENT (REF)	CYCLE	PEAR		③ AVE RAGE	(4) DEMĀND (WATT-HR/	(5) PEAK	6 AVERALE	(1) DEMAND (WATT-HR CYCLE) (1) X (7)
ST.S.  MAXIMUM TOTAL MAXIMUM 101AL  I HER HAL' BEQUIPEMENTS  LATENT SENSIBLE HEAT LEAK 10 COOLART  SOURCE (BTU/HR) (BTU/HR) (BTU/HR) (BTU/HR)  WATER HEAT LOSS.  HO  TOTAL 32.3 (1/0). 29.6 (101). 29.6 (101). 32.3 (1/0).  MATE (BTU/HR). WE'T (BTU/HR). WATT (BTU/HR). WATT (BTU/HR)  SOURCE (BTU/HR/LOSS).  PLERATION AL PENALTIES  HEAT LEAN TO COOLART  FLECTRICAL METGHT. VOLUME  SOURCE (BTU/HR/CYCLE). (BTU/HR/CYCLE). (LE/PISSION). (FT*/MISSION).  N/A  TOTAL	HENTLY (29:	3) .037	5				140	140	5.29
THERMAL REQUIPEMENTS  LATENT SENSIBLE HEAT LEAK TO COOLANT SOURCE (BTU/HR) (BTU/HR) (BTU/HR) (BTU/HR)  WATER HEAT COSS 1/O — 1/O  HEATTER — 71.6 71.6 — 1/O  JATER DOMP — 29.4 29.4 —  TOTAL 32.3 (1/O) 22.6 (101) 23.6 (101) 32.3 (1/O)  WATT (BTU/HR) WATT (BTU/HR) WATT (BTU/HR)  SOURCE (BTU/HR/CYCLE) (BTU/HR/CYCLE) (PK WATTS/CYCLE) (LB/MISSION) (FT*/MISSION)  TOTAL	UNTER PUMP	037	5 57	5	57.5	2.15	· · · · · · · · · · · · · · · · · · ·		
I HERMAL REQUIPEMENTS  LATENT SENSIBLE HEAT LEAK TO COOLANT SOURCE (BTU/IR) (BTU/IR) (BTU/IR)  TOTAL 32.3 (//o) 29.6 (LO1) 29.6 (LO1) 32.3 (//o)  MATT (BTU/IR) WITT (BTU/IR) MATT (BTU/IR) MATT (BTU/IR)  DEFRATION AL PENALTIES  HEAT LEAK TO COOLANT ELECTRICAL MEIGHT VOLUME (BTU/IR/CYCLE) (BTU/IR/CYCLE) (FR MATTS/CYCLE) (LB/MISSION) (FT*/MISSION)  TOTAL  TOTAL	<del></del>						·		•
I HERMAL REQUIPEMENTS  LATENT SENSIBLE HEAT LEAK TO COOLANT SOURCE (BTU/IR) (BTU/IR) (BTU/IR) (BTU/IR)  DATIFIC HEAT LOSS 1/O — 1/O  HEATTER - 7/.6 7/.6 — 1/O  101AL 32.3 (1/O) 29.6 (101) 29.6 (101) 32.3 (1/O)  MATT (BTU/IR) WE'TT (BTU/IR) MATT (BTU/IR) MATT (BTU/IR)  OPERATION AL PENALLIES  HEAT LEAK THERMAL TO COOLANT ELECTRICAL MEIGHT VOLUME (BTU/IR/CYCLE) (BTU/IR/CYCLE) (PK WATTS/CYCLE) (LB/MISSION) (FT*/MISSION)									
I HERMAL' REQUIPEMENTS  LATENT SENSIBLE HEAT LEAK TO COOLANT SOURCE (BTU/IR) (BTU/IR) (BTU/IR)  JATUAL HEAT LOSS 1/O — 1									
I HERMAL' REQUIPEMENTS  LATENT SENSIBLE HEAT LEAK TO COOLANT SOURCE (BTU/IR) (BTU/IR) (BTU/IR)  JATUAL HEAT LOSS 1/O — 1			<del></del>						
I HER MAL REQUIPEMENTS  LATENT SENSIBLE HEAT LEAK TO COOLANT SOURCE (BTU/IR) (BTU/IR) (BTU/IR)  JATUAL HEAT LOSS. 110 — 110  HEAT LEAK TOTAL  TOTAL 32.3 (1/0) 29.6 (101) 29.6 (101) 32.3 (1/0)  MATT (BTU/IR) WE'TT (BTU/IR) MATT (BTU/IR) MATT (BTU/IR)  PER A I I O M A L PEN A L I I ES  HEAT LEAK THERMAL SOURCE (BTU/IR/CYCLE) (BTU/IR/CYCLE) (PK MATTS/CYCLE) (LB/MISSION) (FT*/MISSION)  TOTAL					•				
SOURCE (BTU/IR) SENSIBLE HEAT LEAK TO COOLANT SENSIBLE HEAT LEAK (BTU/IR)  UATER HEAT COSS 1/0 — 1/6  TOTAL 32.3 (1/0) 29.6 (101) 32.3 (1/0)  MATT (BTU/IR) WATT (BTU/IR) WATT (BTU/IR)  OPERATIONAL PENALTIES  THERMAL TO COOLANT ELECTRICAL NEIGHT VOLUME (BTU/IR/CYCLE) (BTU/IR/CYCLE) (BTU/IR/CYCLE) (PK WATTS/CYCLE) (LB/MISSION) (FT'/MISSION)  N/A-					•			•	
LATENT SENSIBLE HEAT LEAK TO COOLANT FLECTRICAL MEIGHT VOLUME (BTU/HR)  SOURCE (BTU/HR) (BTU/HR) (BTU/HR)  DATEN HEAT LOSS 1/0 — 1/6  TOTAL 32.3 (1/0) 29.6 (101) 29.6 (101) 32.3 (1/0)  MATT (BTU/HR) WE'T (BTU/HR) WATT (BTU/HR) WATT (BTU/HR)  SOURCE (BTU/HR/CYCLE) (BTU/HR/CYCLE) (PK WATTS/CYCLE) (LB/MISSION) (FT'/MISSION)  TOTAL  TOTAL									
SOURCE (BTU/HR) SENSIBLE HEAT LEAK TO COOLANT SOURCE (BTU/HR) (BTU/HR) (BTU/HR)  DATER HEAT LOSS 1/0 — 1/6  HUBTER DUMP — 29.4 29.4 —  TOTAL 32.3 (1/0) 29.6 (101) 29.6 (101) 32.3 (1/0)  MATT (BTU/HR) MATT (BTU/HR) MATT (BTU/HR) MATT (BTU/HR)  OPERATIONAL PENALTIES  THERMAL TO COOLANT ELECTRICAL MEIGHT VOLUME (BTU/HR/CYCLE) (BTU/HR/CYCLE) (PK MATTS/CYCLE) (LB/MISSION) (FT'/MISSION)  N/A—			•		•				
LATENT SENSIBLE HEAT LEAK TO COOLANT FLECTRICAL MEIGHT VOLUME  SOURCE (BTU/HR) (BTU/HR) (BTU/HR) (BTU/HR)  TOTAL 32.3 (1/O) 29.6 (101) 29.6 (101) 32.3 (1/O)  MATT (BTU/HR) WATT (BTU/HR) WATT (BTU/HR)  SOURCE (BTU/HR/CYCLE) (BTU/HR/CYCLE) (PK WATTS/CYCLE) (LB/MISSION) (FT*/MISSION)  TOTAL  TOTAL									
SOURCE (BTU/IR) (BTU/HR) (BTU/HR) (BTU/HR)  DATER HEAT LOSS 110 — 110  HEATER — 71.6 — 71.6 — 110  HATER PUMP — 29.4 — 29.4 — 110  TOTAL 32.3 (110) 29.6 (101) 29.6 (101) 32.3 (110)  WATT (BTU/HR) WAST (BTU/HR) WAST (BTU/HR) WAST (BTU/HR)  DPERATIONAL PENALTIES  THERMAL TO COOLANT ELECTRICAL WEIGHT VOLUME (BTU/HR/CYCLE) (BTU/HR/CYCLE) (PK WASTIS/CYCLE) (LB/MISSION) (FT*/MISSION)  N/A — 100  TOTAL TOTAL TOTAL MATT SCANCE (BTU/HR/CYCLE) (BT									
TOTAL 32.3 (1/0) 29.6 (101) 32.3 (1/0)  MATT (BTU/HR) WAST (BTU/HR) WAST (BTU/HR) WAST (BTU/HR)  OPERATIONAL PENALTIES  THERMAL  HEAT LEAK  TO COOLANT  SOURCE (BTU/HR/CYCLE) (BTU/HR/CYCLE) (PK WATTS/CYCLE) (LB/MISSION) (FT*/MISSION)  - N/A-	SOURCE								
TOTAL 32.3 (1/0) 29.6 (101) 32.3 (1/0)  MATT (BTU/HR) WATT (BTU/HR) WATT (BTU/HR)  OPERATIONAL PENALTIES  THERMAL TO COOLANT ELECTRICAL WEIGHT VOLUME (BTU/HR/CYCLE) (BTU/HR/CYCLE) (PK WATTS/CYCLE) (LB/MISSION) (FT'/MISSION)  - N/A-	VATER HEAT	. دعم	_110						10
TOTAL 32.3 (110) 29.6 (101) 32.3 (110)  MATT (BTU/HR) WATT (BTU/HR) WATT (BTU/HR)  OPERATIONAL PENALTIES  THERMAL SOURCE (BTU/HR/CYCLE) (BTU/HR/CYCLE) (PK WATTS/CYCLE) (LB/MISSION) (FT'/MISSION)  - N/A-	HEATER					1.6			
DPERATIONAL PENALTIES  THERMAL TO COOLANT ELECTRICAL MEIGHT VOLUME  SOURCE (BTU/HR/CYCLE) (BTU/HR/CYCLE) (PK WATTS/CYCLE) (LB/MISSION) (FT'/MISSION)  TOTAL	IATER PUM	0		<del></del>	29	7.4	29.4		
DPERATIONAL PENALTIES  THERMAL TO COOLANT ELECTRICAL MEIGHT VOLUME  SOURCE (BTU/HR/CYCLE) (BTU/HR/CYCLE) (PK WATTS/CYCLE) (LB/MISSION) (FT'/MISSION)  TOTAL	populari de como con esta de la como de como de la como de la como de la como de la como de la como de la como			*					<del></del>
DPERATIONAL PENALTIES  THERMAL TO COOLANT ELECTRICAL MEIGHT VOLUME  SOURCE (BTU/HR/CYCLE) (BTU/HR/CYCLE) (PK WATTS/CYCLE) (LB/MISSION) (FT'/MISSION)  TOTAL									<del></del>
DPERATIONAL PENALTIES  THERMAL TO COOLANT ELECTRICAL MEIGHT VOLUME  SOURCE (BTU/HR/CYCLE) (BTU/HR/CYCLE) (PK WATTS/CYCLE) (LB/MISSION) (FT'/MISSION)  TOTAL			27 2 (1)	( ,	201	(Ini)	29/(101	١ 22	3 (110)
OPERATIONAL PENALTIES  THERMAL TO COOLANT ELECTRICAL MEIGHT VOLUME SOURCE (BTU/HR/CYCLE) (BTU/HR/CYCLE) (PK WATTS/CYCLE) (LB/MISSION) (FT*/MISSION)		TOTAL	•	_		•			
THERMAL TO COOLANT SOURCE (BTU/HR/CYCLE) (BTU/HR/CYCLE) (BTU/HR/CYCLE) (PK WATTS/CYCLE) (LB/MISSION) (FT'/MISSION)  TOTAL			#ATT (010	/ /	Wr. I	, b10/11K)	WALL (BIO/NK)	WAI	i (bitti/ne)
THERMAL TO COOLANT SOURCE  HEAT LEAK TO COOLANT (BTU/HR/CYCLE) (BTU/HR/CYCLE) (PK WATTS/CYCLE) (LB/MISSION) (FT'/MISSION)  TOTAL	•								
THERMAL TO COOLANT SOURCE  HEAT LEAK TO COOLANT (BTU/HR/CYCLE) (BTU/HR/CYCLE) (PK WATTS/CYCLE) (LB/MISSION) (FT'/MISSION)  TOTAL									•
THERMAL TO COOLANT SOURCE (BTU/HR/CYCLE) (BTU/HR/CY	• • •				•				
THERMAL TO COOLANT SOURCE (BTU/HR/CYCLE) (BTU/HR/CYCLE) (BTU/HR/CYCLE) (PK WATTS/CYCLE) (LB/MISSION) (FT'/MISSION)  TOTAL			<b>NPFPAT</b>	1084	1 9 5	NAITTE	:		
SOURCE (BTU/HR/CYCLE) (BTU/HR/CYCLE) (PK WATTS/CYCLE) (LB/MISSION) (FT'/MISSION)  TOTAL	•			•	L LL	DEELAL:	2		,
TOTAL			IEAT LEAK	TO CC					
	SOURCE	(BTU	/HR/CYCLE)	(BTU/HF	R/CYCLE)	(PK WATTS/C	(CLE) (LB/MISSI	ON) (FT	'/MISSION)
	- N/A-			•	٠.		•		
	<del></del>								
			<del></del>		<del></del>			•	
		<del></del>							
			<del></del>		<del></del>		<del></del>		

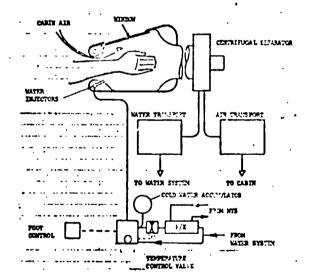
APPLIANCE CONCEPT REQUIREMENTS AND PENALTIES CALCULATIONS (CONCLUDED)

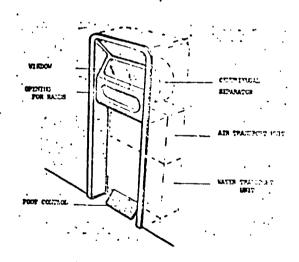
CONCEPT 6/DISPOSABLE CLUMNING CLOTIES/INSPASSABLE DRY WIPES INDEX NUMBER 3.1.1.6

<u> </u>	WEIGHT	VOTAWE BEC	Q U I L E M E N T S	
COMPONENT (REF SQUEE ECR/WATCH DISPENSED DISPOSABLE ORY WIPES	(WaDAC) _	WEIGHT (LBS) 32.4 60.72 41.4		VOLUME (FT <sup>3</sup> ) 1-15 30.19 4.14
TOTA	L_			1.0 (35.43) N³ (FT³)
SOLID EX  TYPE UNITS/CYCLE(REF)  DISPOSIBLE COLVING 2  CLOTHS  DISPOSIBLE DRY 1 (236  WIPES	PENDAB WT/UNI1 (PKG.WT/UN (LB	)		(5) VOL/CYCLE (1) X (4) (FT 1) 
TOTAL VOL _ 15 x	DAYS/HISSION  184 DAYS/HISSION	\( \) \( \)	4	(34.28)
WATER LUSS (	D EXP!  (CYCLE(REF) (LB)  (LZS)  490  20719	ENDABLES R  RECOVERY FACTOR 10009  N/A N/A	EQUIREMENTS  AMT.RECOVERED/CYCLE  ①x② (LB)	AMT LOST/CYCLE (1)·(3) (18) .0005 .025 .0490 .0007/4
Σ① .5	75		ΣΘ	
TOTAL MT	ISSION X TO	TAL LUST/CYCLE	07.6 · .575	KG (LH)

SPACECRAF	T Space Stat	ion	· <del></del>	·
HABITABIL	ITY SUBSYSTE	M Housekeeping	_HABITABILI	TY FUNCTION Equipment Cleaning
APPLIANCE	FUNCTION	Surface Wiping		
APPLIANCE	CONCEPT NO.	/TITLE 7/Disposable	Wet Wipes/	Reusables Dry Wipes
INDEX NO.	3.1.1.7		REF. NO.	286,186

DESCRIPTION The disposable wet wipes/reusable dry wipes concept is identical to concept 1, however reusable dry wipes are used for equipment drying. The terry cloth reusable dry wipes are 15 inches x 30 inches and are used a maximum of 5 times before washing. The wipes are washed and dryed after one day of usage and are discarded after 60 washings. The dry wipes are provisioned 3 per day for a maximum of 15 cleanup functions. The concept is penalized for the usage of a washer/dryer for recycling the drying cloths.





# CONCEPT 7/DISPOSABLE WILT WIPDS/PLUSABLE DRY WIPDS

INDEX NUMBER 3.1.1.7

			POWER	REQUIRE		
COMPONENT (REF)	USF YIME CYCLE (HR)	PEAK (WATTS)	C POWI (3) AVEPAGE (WATTS) 360	DEMAND (WATT-HR/ CYCLE) ① X ③	PEAK (WATTS)	POWER  (A)  AVERAGE (WATT-M CYCLE)  (WATTS)  (WATTS)
		SOO .		13.5 TOTAL	MAX I MUM	. TOTAL
•	•					,
	:	T H E R M A L		REMENIS		
SOURCE		LATENT (BTU/HR)		U/HP)	HEAT LEAK (BTU/HP)	(BIU/HP)
WATER HENT LO	220	360	<del></del>	740		360
MOTURS	1			148	948	
**************************************	<del></del>					
	TOTAL	105.6(360 WATT (BTU/HR)	•	(949)	278 (948 WATT (BTU/HR)	/05.6(360 NATT (BRY)H
•						•
	Õ	PERATION	LAL PE	NALTIES		,
SOURCE	HEAT (BTU/HR/		O COCLANT J/HR/LYCLE)	ELECTRICAL (PK WATTS/CYC	WEIGHT LE) (LB/MISSIG	YOLUME ``) (FT'/MISSIC')
WASHER	-	65				1.66
DRYCE		33.6	62.5	_27.7		
,						
		42.2	18.3	49.7	//.7	.093

#### APPLIANCE CONCEPT REQUIREMENTS AND PENALTIES CALCULATIONS (CONCLUDED)

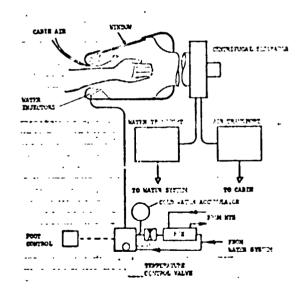
CONCEPT 7/DISPOSABLE WET WIPES/KEUSABLE DRY WIFES

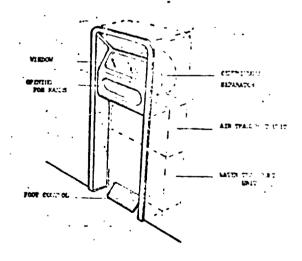
INDEX NUMBER 3.1.1.7

COMPONENT	(055)			EIGHT			VOLUME
WETTING UNIT	(REF) • (236	`		(LBS) 76.69			(FT³) 185.0
DISPOSIBLE WET U		) —		4			103.0
BEUSABLE DRY WI		<del>.</del>		71 <u>.40</u> 103	?	<del></del>	
BEUSEIBLE DET WI	763				<u>,</u>	<del> </del>	
		_		<del></del>		•	
	<del></del>	<del>-</del>					
			<del></del>				
	<del></del>					<del></del>	
						<del></del>	
		_					* <del></del>
	TOTAL	. [	53.75	1184	192	<u> </u>	5.35 (189.31)
	•••	` <b>L</b> _			13/	l	
•		•	KG	(LBS)			M3 (ET3)
							•
, <u>\$ 0 L</u>	I D F X 1	ENDAB		_	K F O T T	REMENIS	•
	•	WT/UNIT	) (REF)	(3) WT/CYCLE	Ε .	VOL/UNIT (REF)	(5) VO! /CYCL E
TYPE UNITS	O /CYCLE(REF)	(PKG.WT/UN: (LB	IT)(PEF)	(LB)	(P	KG. VOL/UNIT) (PE (FT <sup>3</sup> )	F) () x (4) (FT')
				015			, ,
WET WIPES	1(234)		(234)		40 -	.0015	0015
REUSABLE DRYWAS	0166	005	S (24)_	.0001	49	2)6660	%)000060.
							_
			<del></del>		_		_
			<del></del>		<del></del>		
	•		$\Sigma$ $_{ m 3}$ $_{ m -}$	101AL NY/C	<i>19</i>	$\sum ($	5 .0015608
				(LB)	1666		(FT')
TOTAL WT.		101		-40		<u></u>	COL MIGN
THISSION CYCLES/DAY	XDA	184 TYS/MISSIUN'''	X <i>o</i>	15149 11.417(YCC			9.96 (41.81) KG (LB)
1	•	,	• • • • • • • • • • • • • • • • • • • •	(LB)			10 (11)
TOTAL VOL		,00		M-1-1.00		[7	22 (1.21)
CYCLES/DAY	X <sub>DA</sub>	YSZMISSION -		<b>ロ/ン<i>し</i>つと</b> け、vol./cycl.i		L	M1 (177) (4.51)
		•		(FT <sup>3</sup> )			•
G A	<u> </u>	FYDI		1 4 9 1		EMENIS	•
	27 2 2 2 2 2 2	. 1253				_	•
• •	(	D		0	AMT . REC	OVERED/CYCLE	AMT LOST, CYCLE
	AHT. USED/C			OVERY		D) x (Q)	(Ú - (J
TYPE	, (1	8) ´		TOR 2009	1	995	-0005
WATER LOSS (WETWI	(4)	454		1/4		272	.0454
OKRIGEN MILE DIZAN		00719		1/0		V/0	000719
WASHER WATER	(C)	00117		VH		<i>Y//</i> 1	
LOSS PONNUTY	61	<del></del>	1-1	2009	5/	0954	10459
LESS P CIVILLI	.,			2007	عامير		
~~~						50	
. <b>\Sigma</b> (1)	) <u>5.6</u>	<u>د</u>	•			2.0	.05121
			•				
MISSION 15	x 189	¢ 'x .	.05/2/	- 141	.34 .	5.64 .	66.67 (146.99)
CYCLE/DAY	DATS/MIS	STUV TO	AL TOSTICY	LE.			KG (LB)
			<b>a (3</b> )	(1	LB)	<b>4 0</b>	

SPACECRAFT	r Space Sta	ition	<del></del>	
HABITABIL	ITY SUBSYSTE	M Housekeeping	HABITABILITY	FUNCTION Equipment Cleaning
APPLIANCE	FUNCTION_	Surface Wiping		
APPLIANCE	CONCEPT NO.	/TITLE 8/Reusable	Wet/Dry Wipes	
INDEX NO.	3.1 1.8		REF. NO	236,186

DESCRIPTION The reusable wet/dry wipes concept is identical to concept 2; however reusable dry wipes are used for equipment drying. The terry cloth reusable dry wipes are used a maximum of 5 times before washing. The wip 5 are washed and dried after one day of usage and are discarded after 60 washings. The dry wipes are provisioned 3 per day for a maximum of 15 cleanup functions. The concept is penalized for the usage of a washer/dryer for recycling the cleaning and drying cloths.





### APPRIANCE CONCEPT REQUIREMENTS AND PENALTIES CALCULATIONS CONCEPT B/REUSABLE WEI/DKY WINES

INDEX NUMBER 3.1.1.8

TOTAL

MUMIXAM

#### ELECTRICAL POWER REQUIREMENTS DC \_ POWER\_ (7) DEFYND (WATT HM/ (4) DEMAND DZE JIME 0 3 (3) **6**) (WATT HP/ CYCLE PEAK AVERAGE AVERAGE PEAK (D) (I) (1) x (1) COMPONENT (REF) (HR) (WATTS) (WATTS) (WATTS) (WATTS) 13.5 500 WETTING UNIT (2%) . 0375 360 13,5 500. MUMIXAN TOTAL

#### THERMAL REQUIPEMENTS

SOURCE	LATENT (BIU/HR)	SENSIBLE (BTU/HR)	HEAT LEAK (BTU/HR)	TO COOLANT (BTU/HF)
WATER HEAT LOSS	360	948	948	360
amagining approach in the ambinormachines yet with the a specialistic in a second adolps and	*		-	a managana a a a
TOTAL	1 <u>05.6 (360)</u> NATT (BTU/HR)	278 (948) WATT ("TU/HR)	278. (948) WATT (BTL/HR)	105.6(360) NATT (BTU/HP)

#### <u>PENALTIES</u> OPERATIONAL

, SOURCE	. THE HEAT LEAK (BTU/HK/CYCLE)	RMAL TO COULANT (BTU/HR/CYCLE)	ELECTRICAL (PK WATTS/CYCLE)	WEIGHT (LB/MISSION)	VOLUME (FT*/MISSION)
WASHER DRYCK	547 39.4		25.9	21.77	1.95 1.92
` <del>,</del>					
TOTAL	172 (5869) WATIS/CYCLE (BTU/HR/CYCLE)	21.6 (73.6) DATTS/C-CLE (BTU/MP/CYCLE)	<i>5</i> 8.5	13.83 (30.48) ROMISSION	.109 (3.87) h'/hission (ft'/hission)

APPLIANCE CONCEPT REQUIREMENTS AND PENALTIES CALCULATIONS (CONCLUDED)

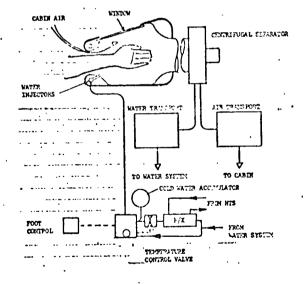
CONCEPT BIREVSABLE WLTDRY WIPES

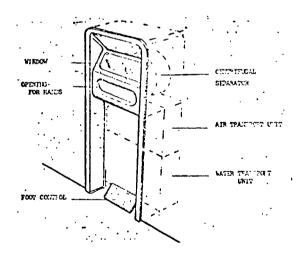
INDEX NUMBER 3.1.1.8

COMPONENT WETTING UNIT	(REF)	M E T 7 H 1/	WEIGHT (LBS)		٠ ٠ ٠ ٠	VOLUME (FT <sup>3</sup> )
REUSIBLE WET L KEUSIBLE DRYL	UIPES		.18	******		.12
	TOTAL .		13.1 (2 KG (LBS)	8.83)	.10	)7 (3.78) M³ (FT³)
· . <u>s</u>	OLID EXP	ENDABL ② WT/UNIT	REF) WT/CY	CLE VO	⟨Φ⟩ L/UNIT (REF)	O VOL/CYCLE
WET WIFES .	NITS/CYCLE(REF) 0167 (23%)	(PKG.WI/UNI (LB)	(18) (256) _0000	663 .C	-	(FT <sup>3</sup> ) 6)_00004Z1_
DRY WIPES .	0167 (236)	.0085	(iiib) .OCD [	48	0366 (25	() <u>.000608</u>
	•		Σ3 .0002 101AL WT (LB	C14 /CYCLE	Σ③	TOTAL VOL/CYCLE (FT3)
TOTAL WT. CYCLES/	DAY DA	YS/MISSION	XX	1E .	.15	kg (LB) (.34)
TOTAL VOL - /5 MISSION - CYCLES/	DAY X	R4 VS/MISSTON	x .COOLO. TOT.VOL/CY (FT <sup>3</sup> )		.000	8 (.28)
	G V 2/F 1 6 A 1 D		NDABLES ②	<u>R E Q U I R E</u>	<u>M E N I S</u>	•
TYPE WATCK	AMT.USED/C (L)		RECOVERY FACTOR 10009		EŘFD/CYCLE X ② LB)	AMT LOST/CYCLE (1)-(3) "(LB) .0005
WASHEK WAT LOSS PENACTY	5.27 - 5.27		10009	5.21.	53	.0047
. Σ					Σ⊙	.0052.
TOTAL WT	x x	z sion x	0052, AL LOST/CYCLE • 1	(4,35 + _,	<u>5.72</u> · [	9.1 (20.07)

SPACECRAFT	Space Station	·	
HABİTABILI	TY SUBSYSTEM Housekeeping	HABITABILITY FUNCTION Equipment Clea	<u>ani</u> ng
APPLIANCE	FUNCTION Surface Wiping		
APPLIANCE	CONCEPT NO./TITLE 9/Reusable	e Cleaning Cloths/Dry Wipes	
INDEX NO.	3.1.1.9	REF. NO. 236,237,245	

DESCRIPTION The reusable cleaning cloths/dry wipes concept is identical to concept 5; however, reusable dry wipes are used for equipment drying. The terry cloth reusable dry wipes are used a maximum of 5 times before washing. The wipes are washed and dried after one day of usage and are discarded after 60 washings. The dry wipes are provisioned 3 per day for a maximum of 15 cleanup functions. The concept is penalized for the usage of a washer/dryer for recycling the cleaning and drying cloths.





# APPLIANCE CONCEPT REQUIREMENTS AND PENALTIES CALCULATIONS CONCEPT 9/REUSABLE CLEANING CLOTHS/DRY WINES

INDEX NUMBER 3.1.1.9

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	-			_	-	• •	_	_			_					-	٠.			-	-		-	• •	<u> </u>	

		A	C . POWE	R	D	C POWF	
COMPONENT (REF)	USE TIME  CYCLE  (HR)	② PEAK (WATTS)	③ AVERAGE (WATTS)	(4) DEMAND (WATT-HP/ CYCLE) ① X ③	(5) PEAK (WATTS)	⑥ AVERAGE (WATTS)	(7) DEMAND (WATT-HR/ CYCLE) ① X (7)
WETTH SUKIT (234)	.0375	500	360	13.5			
					·		<b>,</b>
							******
		<del></del>					-
		•	<del></del>			<del></del>	
		500. MAXIHUM		13.5 TOTAL	MAXIMUM	•	, 101AL

#### THERMAL REQUIREMENTS

SOURCE	LATENT (BTU/HR)	SENSIBLE (BTU/HR)	HEAT LEAK (BTU/HR)	TO COOLANT (BTU/HP)
MATER HEAT LOSS	360			_360
		-		
TOTAL	<i>105.6 (360)</i> WATT (BTU/HR)	278 (948) WATT (BTU/HR)	278 (943) WATT (BIJ/HR)	105.6(360) WATT (BTU/HT)

#### OPERATIONAL PENALTIES

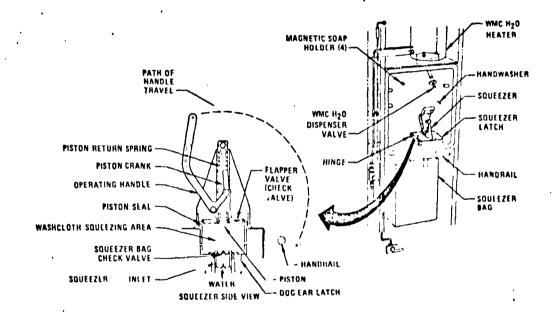
•	' THE	ERMAL	PLECTOTON	UETOUT	MOL LIME
SOURCE.	HEAT LEAK (BTU/HR/CYCLE)	TO COOLANT (BTU/HR/CYCLE)	ELECTRICAL (PK WATTS/CYCLE)	WEIGHT (LB/MISSION)	VOLUME (FT <sup>3</sup> /MISSIGN)
WASHER DRYER	636 459	85.4	30 _37.7	25.3 10.1	2.27 2.23
<b>\</b>					
T(	181.5  OTAL (681.9) WATTS/CYCLE (BTU/HR/CYCLE)	25.0 (85.4) WATTS/(YC(E (BTU/HR/CrCLE)	67.7	/6.06 (35.4) KG/MISSICY (LB/MISSION)	./27 (4.50) m'/MISSION (FT'/MISSION)

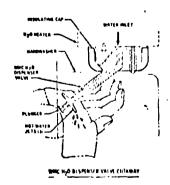
CONCEPT 9/KCUSOBLE CLEANING CLOTHS/ DRY WIFES INDEX NUMBER 3.1.1.9

	<u>EIXED WE</u>	<u>I G H T</u> /y O L U	ME R <u>E</u> Q	<u>U I R E M E N T S</u>	<u>.</u>	
COMPONENT WETTING UNIT	(REF) • (23%)		WEIGHT (LBS) 28,49		VOLUME (FT <sup>3</sup> ) 3,5	
CLETINING CLOTH	\$		3.59		2.5L	
REUSABLE DEY WIF	265	,	41			<del></del>
					1	
		•				
		•				
	TOTAL	14.	74 (27	.49)	.175	(6.13)
	14=	<u> </u>	KG (LBS)	<u>-17</u> )	M <sup>3</sup> (FT <sup>3</sup> )	(6.10)
,					, N.T.E	•
, <u>\$</u> 0 <u>F</u>		<b>②</b>	MI/CAČFE 3 MI/CAČFE	REQUIREME! (4) E VOL/UNIT		(3)
TYPE UNIT:		WT/UNII (PEF) KG.WT/UNIT)(REF) (LB)	①x② (LB)	PKG.VOL/UNIT (PKG.VOL/U (FT3	(REF) VOL) NIT)(REF) (1	CYCLE ) x (4) FT <sup>3</sup> )
CLEANING CLOTHS .		.077	0013		(209) .00	
REUSABLE DLYWING .C	2167 (236)	.0099	.0001	43 1003	36 (2%) .CO	20608
	•	$\Sigma$	101AL WT/CY	18	Σ (S) LOCAL TOTAL	9708
TOTAL WT.			(LB)		(1	T)
THISSION CYCLES/DAY	x X	<i>4</i> Mission x	.00/448 101.WI/CYCLE	3_ * . L	1.813 KG (LB)	4.0)
TOTAL VOL	10		(LB)	. r	07/	5/01
MISSION CYCLES/DAY	X DAYS/	MISSION X	.000970 TOT.VOC/CYCLE (FT3)		.076 . M <sup>3</sup> (H <sup>3</sup> )	2.60)
. <u>G</u> <u>A</u>	<u>\$/L 1 Q U I D</u>	EXPENDAB	LES RE	<u> QUIREMEN</u>	<u>T S</u>	
, ,	0	•	<b>②</b>	③ AY'.RECOVERED/C	YCLE AMT LOS	<b>₫</b> ST/ <b>C</b> YCLE
TYPE	AMT.USED/CYCL (LB)	E (NEI)	ECOVERY FACTOR	① x ② (LB)	( <u>)</u>	· (1) .B)
WATER WATER	, .5		.0009	4995		5
LOSS PENALTY	5.25		.0009	5.2453	.004	7
, Σ'	5.75			•	ΣΦ .005.	<u></u>
TOTAL WT 15	x 184	x ,005	2 . 14.	35 + 5.72	9.1	(20.07)
CYCLE/DAY	DAVSTMISSIO	NT TOTAL 1 05T/ CZ (3)	CYCLE	.B) (z ()	kG	(LB)

SPACECRAFT Space Station	
HABITABILITY SUBSYSTEM Housekeepi	ing HABITABILITY FUNCTION Equipment Cleaning
APPLIANCE FUNCTION Surface Wip	ing
APPLIANCE CONCEPT NO./TITLE 10/Di	sposable Cleaning Cloths/Reusable Dry Wipes
INDEX NO. 3.1.1.10	REF. NO. 236,283

DESCRIPTION The disposable cleaning cloths/reusable dry wipes concept is identical to concept 6; however reusable dry wipes are used for equipment cleaning. The terry cloth reusable dry wipes are used a maximum of 5 times before washing. The wipes are washed and dried after one day of usage and are discarded after 60 washings. The dry wipes are provisioned 3 per day for a maximum of 15 cleanup functions. The concept is benalized for the usage of a washer/dryer for recycling the drying cloths.





# APPLIANCE CONCEPT REQUIREMENTS AND PENALTIES CALCULATIONS CONCEPT 10/015/05/18LE CLETINING CLOTIS/PLUSABLE DRY WIPES

INDEX NUMBER 3.1.1.10

ELECTRICAL POWER REQUIREMENTS	
-------------------------------	--

	· ·	Α.	C POWE		D	C POWER				
	USE TIME	② .	(3)	(4) DEMAND (WATT-HP/	(5)	<b>(</b> )	(7) DE1714D (WATT-HHZ)			
COMPONENT (REF)	CYCLE (HR)	PEAK (WATTS)	AVERAGE (WAITS)	CYCLE) (1) X(3)	PEAK (WATTS)	AVERAGE (WATTS)	CYCLE) (1) x (1)			
HUTTER (293)	.0375				190	190	5.25			
WATER PUMP	.03.75	57.5	57.5	2.15	•					
				<del></del>			•			
	-									
	<del></del>									
		<del></del>								
				,						
		•				•	*			
		57.5.	•	2.15	140		5.25			
,		MAXIMUM		TOTAL	MAXIMUM		TOTAL			

### THERMAL REQUIREMENTS

SOURCE	LATENT (BTU/HR)	SENSIBLE (BTU/HR)	HEAT LEAK (BTU/HR)	TO COOLANT (BTU/HP)
WATER HEAT LOSS HCATER WATER PUMP		-71.6 29.4	71.6 29.4	
TOTAL	32.3(110) WATT (BTU/HR)	29.6 (101) WATT (BTU/HR)	29.6 (101) WATT (BTU/HR)	<i>32,3 (1.10)</i> WATT (BTU/HR)

### OPERATIONAL PENALTIES

	••	' THE	d4AL	ELECTRICAL	WEIGHT	VOLUME		
SOURCE		HEAT LEAK (BTU/HR/CYCLE)	TO COOLANT (BTU/HR/CYCLE)	(PK WATTS/CYCLE)	(LB/MISSION)	(FT <sup>3</sup> /MISSION)		
WASHER		465		_2z	18.50	1.66		
DRYER		33.6	62.5	27.7	7.40	1.63		
. 1	<del></del>					-		
``		(43.3	10 7			.093		
	TOTAL	142.2 (498.6) HATTS/CYCLE (BTU/HR/CYCLE)	(62.5) WATTS/CYCLE (BTU/HR/CYCLE)	49.7	(25.9) KG/MISSION (LB/MISSION)	(3.29) (3.29) (613/M12510N (613/M12510N)		

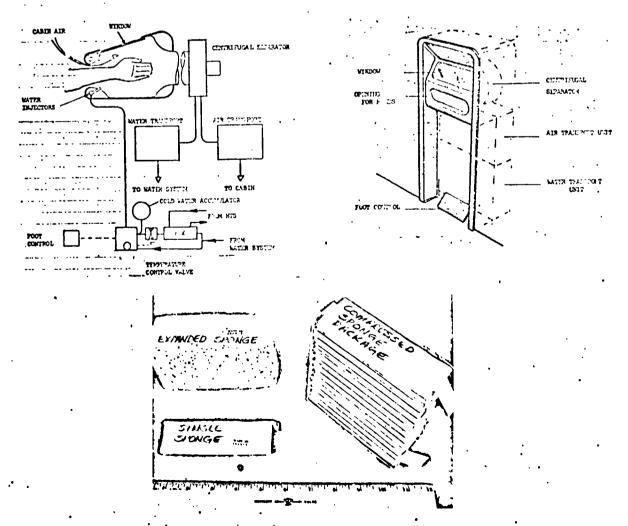
#### APPLIANCE CONCEPT REQUIREMENTS AND PENALTIES CALCULATIONS (CONCLUDED)

CONCEPTIONS POSABLE CLEANING CLOTHS/KEUSABLE DEY WIPES INDEX NUMBER 3.1.1.10

COMPONENT	(REF)	WEIGHT (LBS)		VOLUME (FT <sup>3</sup> )
_	14. N. D. T. ( Mr. Dac )	32.4		1.15
	NGCLOTHS	60.72		30.14
PEUSINELE DUY WIF				.17
		<del></del>		
			<del> </del>	
	TOTAL .	42.45 (43.	दशी -	12132
	TOTAL .	<del></del>	33/	B9 (31.46)
•	•	• KG (LBS)	•	M <sup>3</sup> (FT <sup>3</sup> )
		0.1 E 11 TW C 1 B		•
· <u>\$ 0 L I</u>	D EXPENDA		EQUIREMENTS (4)	, (8)
	TI (PXG WT/UNI	T (REF) WT/CYCLE	'L/UNIT (PEF	) NOT (CACTE
TYPE UNITS/	(1.100.111)	UNÎT)(REF) (ÎX (2) LB) (LB)	(FKG.VOL/UNIT)(1 (FT <sup>3</sup> )	(EF) (1) x (4) (FT <sup>3</sup> )
	2 .07	7 (NASO) 022	1092	.01092
MINING	10	18 (100)	18 003661	
ROUSTBLE DRY	161(236)00	<u> </u>	0 003000	
		<del></del>	·	·
<del></del>	······································			
	<del></del>	50 02314	~ ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	0 0109808
	•	$\Sigma$ $\odot$	<u>s</u>	(5) .0109808
		(LB)		(FT <sup>3</sup> )
TOTAL WT 15	x 184	x .022148	2	7.73 (61.13)
CYCLES/DAY	DAYS/MISSIO			KG (LB)
TOTAL_VOL		(LB)		
MISSION/S	x 184	x .010980	8 .	358 (30.31)
CYCLES/DAY	DAYS/MISSTO	TOT. VOL/CYCLE  (FT3)	•	M3.(E13),
•				
			•	•
· <u>G A S</u>	TIONIO EX	<u>PENDABLES</u> <u>RE</u>	QUIREMENTS	
	•	0	<b></b>	AMT LOST/CYCLE
	AMT.USED/CYCLE(REF)	RECOVERY	AMT. RECOVERED/CYCLE  OX	AMT LOST/CYCLE
TYPE	(LB)	' FACTOR	(LB)	(LB)
WATER		10009	.4995	.0005
WASHER WATER				
LOSS PENNITY	5.1	10009	5.0954	.0046
WATCK LOSS (CLITIKING)				
CLOTH)	025	N/A		.025
$\Sigma$	5.625	-	$\Sigma$ $@$	0.301
TOTAL WT 15	184 .	0301 - 83	03 . 5.6	40.Z (88.7)

SPACECRAFT	Space Station	<del></del>	
HABITABILI	TY SUBSYSTEM Housekeeping	HABITABILIT	Y FUNCTION Equipment Cleaning
APPLIANCE	FUNCTION Surface Wiping		
APPLIANCE	CONCEPT NO./TITLE 11/Sponge	s/Enclosed Wet	ting Unit
INDEX NO.	3.1.1.11	REF. NO.	236,170

DESCRIPTION The sponges/enclosed wetting unit concept uses the wetting unit described by concept 1. The sponges are compressed and are used for pickup of spills of any type and general cleanup. The sponges are made of cellulose material which expands to approximately 15 times its compressed volume when soaking up liquid. A single compressed sponge is 5 inches long by 1.6 inches wide by .25 inches depth. The sponge volume is 2.0 cubic inches and weighs 18 grams. The wetting unit is used for wetting/wringing the sponges during cleanup. The sponges are used for cleanup and drying. Five sponges per day are provisioned for a maximum of 15 cleanup and drying functions. Each sponges is used 3 times and discarded into the refuse system.



### APPLIANCE CONCEPT REQUIREMENTS AND PENALTIES CALCULATIONS CONCEPT ///SYONGES/ENCLOSED WETTING UNIT

INDEX NUMBER 3.1.1.11

	ETEC		DWER	REQUIR		
	USE TIME	A C  PEAK	POWE 3 AVERAGE	R (4) DEMAND (WATT-HR/ CYCLE)	© (S) PEAV	(NATT-HR  AVERAGE CYCLE)
COMPONENT (REF)	(HR)	(WATTS)	(WATTS)	①x③	(WATTS)	(WATTS) (D)(D)
WETTING UNIT (236)	.0375	500	360	13.5		
• .				<del></del>		
		•				•
		500.	•	13.5	MA VIII III	
•		MUMIXAM		TOTAL	MUMIXAN	, TOTAL
	•	•				•
			•		,	
		THERMAL	REQUI!	REMENTS		
•		LATENT	Ct no	STBLE	HEAT LEAK	TO COOLANT
SOURCE	RCE			J/HR)	(BTU/HP)	(BTU/HP)
WATER WENT LO	~ •	360		_		26.0
MOTORS	3 <u>.7</u>		9	48	948	
		<del></del>				• • • • • • • • • • • • • • • • • • • •
						· · · · · · · · · · · · · · · · · · ·
<b>,</b>	0741	105.6 (360)	276	(948)	278 (940	2) 105/(3/10)
•	OTAL /	WATT (BTU/HR)		(BTU/HR)	WATT (BTU/HR)	
•		•			•	<b>(1</b> 1),
				•		
				•		·
<b>V</b>				•	•	•
		<u>DPERATIONA</u>	LL PE	NALTIES	<u>.</u>	•
1	HEAT	THERMAL T LEAK TO C	OOLANT	ELECTRICAL		
SOURCE	(BTU/HR	/CYCLE) (BTU/H	IR/CYCLE)	(PK WATTS/CY	CLE) (LB/MISSI	ON) (FT <sup>3</sup> /MIS510N)
-N/A-			· .		•	
		•				
		· · · · · · · · · · · · · · · · · · ·				
<u> </u>		<del></del>	<del></del>		<del></del>	
		······································				
. 101	AL .					

WATTS/CYCLE (BTU/HR/CYCLE) KG/MISSION)

(ELIMIZZIOA)

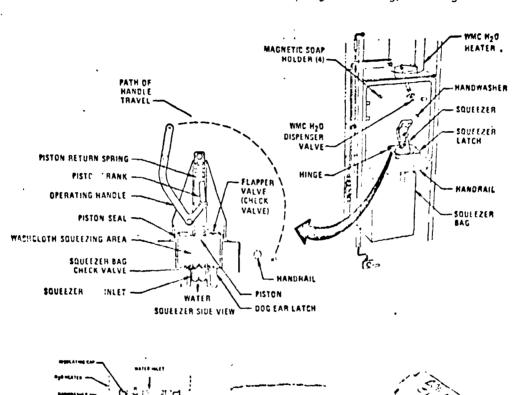
WATTS/CYCLE (BTU/HR/CYCLE) APPLIANCE CONCEPT REQUIPEMENTS AND PENALTIES CALCULATIONS (CONCLUDED)

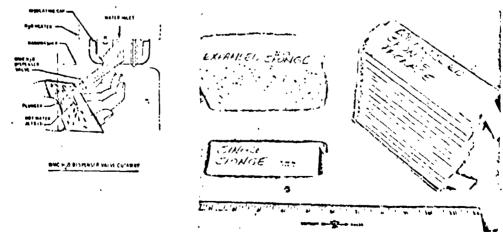
CONCEPT // SPONSICS /LKCLOSED WETTING UNIT INDEX NUMBER 3./././

	FIXED	NEIGHT/V	OLUME RE	$\underline{Q}\;\underline{U}\;\underline{I}\;\underline{R}\;\underline{E}\;\underline{M}\;\underline{E}\;\underline{N}$	<u>T S</u>	
COMPONENT  WETTING UNIT	(REF) • (236)	)	WEIGHT (LSS) 28.49			OLUME FT3)
SPONGES	(170)		36.46			06
					•	
;	TOTAL .	. [	29.46 (64 KG (LBS)	1.95)	.129	(H3)
		ENDABLE		REQUIREM		(117)
	OLID EXP  O UNITS/CYCLE(REF)	WT/UNIT (PE (PKG.WT/UNIT) (LB)	F) WT/CY( (REF) ①X( (LB)	) CLE VOL/I ) (PKG.VC	(4)	(5) VOL/CYCLE (1) x (4) (F1 <sup>2</sup> )
SPONGIES	.333	0397	(170)0132		0116(170)	.000385
	,		∑3 _,0/3 ≥ TOTAL WT/	CYCLE	Σ (§	-000395 TUTAL VOL/CYCLE
TOTAL WT. = 15 MISSION CYCLES	/DAY X DA	184 PS/MISSION	X		[ 16.5 ku	
MISSION - 15	/DAY X — DA	184 is/missiön	x00038 TOT. VOL. /CYO (FT <sup>3</sup> )	٠ .ii	.030 M	(1.06)
	<u>G A 5/L 1 Q U 1 D</u>	<u> </u>		REQUIREME TO THE ME		
TYPE WATEK	AMT.USED/C (L)	CLE (REF)	PECOVERY FACTOR	3 AMT.RECOVEFF ① X (2 (LB)	)	AMT LOST/CYCLE (1)-(3) (18) .0005
WHTER LOSS (SI DISPOSAL)	PONGE .O	283	N/A			0083
	Σ ①	83	-		Σ⊙	0088
TOTAL WT 15 WISSION - CYCLE/UA	x BAYS/MIS	x SION X TOTAL	2088 : 2 1051/1700	4.295	<i>Made</i> . I	11.25 (24.8)
4.444/011			<b>(2</b> (3)	(LB) (Z	0	,,

SPACECRAFT	Space Station		
HABİTABILI	TY SUBSYSTEM Hous	ekeeping HABITABILI	TY FUNCTION Equipment Cleaning
APPLIANCE	FUNCTION Surface	Wiping	
APPLIANCE	CONCEPT NO./TITLE_	12/Sponges/Skylab Nett	ing Unit
INDEX NO	3.1.1.12	REF. NO	236,170

DESCRIPTION The sponges/Skylab wetting unit concept is identical to concept 11; however the Skylab wetting unit is used for aponge wetting/rinsing.





# APPLIANCE CONCEPT REQUIREMENTS AND PENALTIES CALCULATIONS CONCEPT 12 SPONGES SKYLMB WETTING UNIT

INDEX NUMBER 3.1.1.12

<u> </u>	E	C	T	R	1	C	A	L	P	٥	W	F	R	R	F	n	Ħ	ı	R	F	H	F	N	T	S

	•	A (	POWE		D (	C POWE	
	USE TIME	2	(3)	DEMAND	(5)	<b>6</b>	DEMAND
COMPONENT (REF)	CYCLE (HR)	PEAK (WATTS)	AVERAGE	(WATT-HP/	PEAK	AVERAGE	CYCLE)
• • •		(MAIIS)	(WATTS)	Ox3	(WATTS)	(WATTS)	①x①
HLATTY (283)	.0375				190	190	25.25
WHIEK PUMP	.0325	57.5	57.5	2.15			
	<del></del>						
				<u></u> -	<del></del>		
			·				
					<del></del>		
	•	57:5	•	2.15	140	•	5.25
•		MAXIMUM '	,	TOTAL	MAXIMUM		TOTAL

### THERMAL REQUIREMENTS

. SOURCE		LATENT (BTU/HR)	SENSIBLE (BTU/HR)	HEAT LEAK (BTU/HR)	TO COOLANT (BTU/HR)
WATER HEATER WATER P			71.6 29.4	71.6 29.4	
\	TOTAL	32.3(110) MATT (BTU/nR)	29.6(101) WATT (BTU/HR)	29.6(101) NATT (BTU/HR)	32.3(110) WATT (BT: /HR)

#### OPERATIONAL PENALTIES

	THE HEAT LEAK	RMAL TO COOL NUT	ELECTRICAL	WEIGHT	• <b>VOL</b> UME
SOURCE	(BTU/HR/CYCLE)	TO COOLANT (BTU/HR/CYCLE)	(PK WATTS/CYCLE)	(LB/MISSION)	(FT <sup>3</sup> /MISSION)
- N/A -				•	
<u> </u>					·
. 101	MATTS/CYCLE (BTU/HR/CYCLE)	MATTS/CYCLE		RG/MISSION (LR/MISSION)	H <sup>3</sup> /HISSION (FT <sup>3</sup> /HISSION)

APPLIANCE CONCEPT REQUIPEMENTS AND PENALTIES CALCULATIONS (CONCLUDED)

CONCEPT 12/SPONGES/SKYCHB (NETTING UNIT INDEX NUMBER 3,1.1.12

OMPONENT SOUTHZER/WATER DI	(REF)	WEIGHT (LBS) 32.4		VOLUME (FT <sup>3</sup> ) 1.15
SAXIGES	(176)	36.46		1.00
	TOTAL	31.23 (688 KG (LBS)	6) .0	06'3 (ZZI) N <sup>3</sup> (FT <sup>3</sup> )
	. ((	LE W 1/V OL R  D	EQUIREMENIS  VOL/UNIT (PEF, (PKG. VOL/UNIT) (FT)  (FT)	(S) VOL/CYCLE
TAL WT.		Σ① _0/32/ 101AL HT/L10		(FT')
TAL VOL	X	X X 101. W/CYCLE (LB)  X X 20395		30 (117)
TYPE	S/L 1 Q U 1 D E X P  O  AMT.USED/CYCLE(REF) (LB)	ENDABLES RE  O  RECOVERY FACTOR	QUIREMENTS  ANT. RECOVERED / CYCLE  (LB)	AMT LOST/CYCLE  ()-() (LB)
WATER LOSS (SPO WSPOSAL)				.0005
	•			

HABITABILITY SUBSYSTEM 3.0	Housekeeping
HABITABILITY FUNCTION 3.2	Refuse Management
APPLIANCE FUNCTION 3.2.1	Manual Collection
. NUMBER OF CONCEPTS CONSIDER	D 3

#### **ASSUMPTIONS**

1. The manual collection of refuse utilizes crewman collection of refuse. The collection devices considered were bags and stationary containers.

2. The refuse mix used for the compressible/noncompressible refuse is summarized

on the next page. The refuse mix was based on reference 203.

3. The total compressible and uncompressible refuse volume was divided by the volumetric capacity of the collection devices to obtain the total number of devices

required for the missions.

4. The study assumed no compaction for the compressible that collection devices. Reference material stated that 20 percent compressible was possible by manual compaction by the crewman. However, the conservative approach was taken by assuming no trash compaction because of the variety of collection devices presented the 20 percent might not always apply.

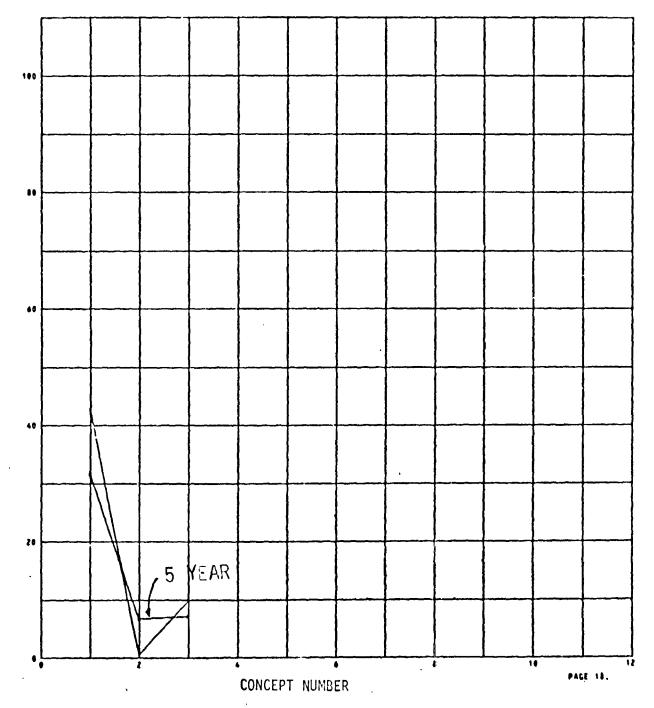
5. The weights and volumes of the refuse from all sources are summarized in

Table C2-6.

•	1710	LL OL O			
	SPACE STATION/SHU	TTLE REFUSE	SUMMARY_		
,		SPACE STATION (LBS)	SHUTTLE (LBS)		SHUTTLE (FT?)
TRASH	COMPRESSIBLE Health & Safety Crew Quarters Food/Drink Crew Hygiene ECS RCS Power Structural Maintenance Communications Data Collection  COMPRESSIBLE REFUSE TOTAL	11.10 120.62 566.2 171.32 0 0 21.15 0 .25	1.296 115.4 32.93 107.58 0 0 0 .236 0	11.59 128.7 13.08 129.36 0 0 .281 0 .006	.372 2.39 .993 2.48 0 0 0 .030 0 0
BAGS	NONCOMPRESSIBLE  Health & Safety Crew Quarters Food/Drink Crew Hygiene ECS RCS Power Structural Maintenance Communications	0 0 0 0 0 0 0	0 0 0 0 0 0 0	0 0 0 0 0 0 0	0 0 0 0 0 0 0
PISPOSAL	NONCOMPRESSIBLE REFUSE TOTAL  COMPRESSIBLE  Health & Safety Crew Quarters Food/Drink Crew Hygiene LCS RCS Power Structural Maintenance Communications	0 144.0 0 3975.56 61.42 36.98 1.75 0	0 10.80 0 314.12 2.67 6.95 0 0	5.14 0 158.37 3.64 .57 .04 0	.386 0 12.237 .095 .43 0 0 0
MISPUSAL	COMPRESSIBLE REFUSE TOTAL	4219.71	334.54	167.76	13.15
BAGS	NONCOMPRESSIBLE  Health & Safety Crew Quarters Food/Drink Crew Hygiene ECS RCS Power Structural Maintenance Communications Data Collection	0 0 0 11.38 26.17 207.03 55.16 51.25 96.998 8.31	0 0 .39 0 0 0 0	0 0 .72 .14 13.43 .730 .206 1.82 .078	0 0 0 .002 0 0 0
\	MONCOMPRESSIBLE	456.30	.39	17.12	.002

	Take 20be	IL INDEX REIGHT	142.4 ( 314.0) 110.2 ( 243.0) 144.2		
	DEVELOPHENT FORT		20 20		
	OL REGMTS	MT VOLUME CC 4- S) (CU FT)	1 22.511 1.56 1 (55.14) 1 (55.14)	CC (FT <sup>3</sup> /MIN) (LE/HR) (LE/HR) (LE/HR) (LE/HR) (LE/HR) (LE/HR) (LE/HR) (LE/HR) (LE/HR)	۲)
	RECHTS WT/VOL	16 PER   15   15   15   15   15   15   15   1	(1933) (1946) (1946) (1946) (1946) (1946)	). LITERS/SEC * KG/HR * KS/HR * KS/HR * KS/HR * KG/HR * KG/HR * KG/HR * KG/HR	(***)COST IMDICATOR 0-25% 25-50% 56-75% 75-100%
	ELEC PWR RE		00 00 00	(CIRCULATED), (LCST), (LOST), (CIRCULATED), (LOST), (LOST), (LOST), (USED), (CIRCULATED), (CIRCULATED), (CIRCULATED), (PROCESSED),	REQUIRED EQUIRED
CTION ISPACE STATION)	2 1 1 2 1 1 2 1 1 1 1 1 1 1 1 1 1 1 1 1	LEAK ATTS- U/HR)		CASIN AIR CASIN AIR OXYGEN COSLING WATER WATER WITHOSEN HITHOSEN FRECH	(**) <u>AVAILABLE</u> AVAILADLE STATE OF THE ART SOME DEVELOPMENT REQUIRED EXTENSIVE DEV. REQUIRED
E STATION;	THERMAL	COOLACT KT		# 256480V 600	(1) AVA (2) STA (3) SOY (4) EXT
ב כפרובי	OF REDUIREMENTS	- PRESS TEVE - PREG C- - PSIG) (DEG F)		ORIGIN OF PO	IAL PAGE IS
NANUAL REFUS	: A .	1.6 (1.5 (1.5 (1.5 (1.5 (1.5 (1.5 (1.5 (1.5		E TRASH BAG RASTE RECEPTICLES E WASTE RECEPTICLES	
INDER NO. 3.2.1			000.	CONCEPT CONC CONCEPT CONC NO. CONCEPT 1 DISPOSABLE 2 REUSABLE 3 DISPOSABLE 3 DISPOSABLE	
<u> </u>	CC	0 0	0 0 0		

C2-399



Manual Refuse Collection (Space Station)
Concept Trade
C2-400

	-			1	1		;	:
	SELECTION	* XIXIX	112/09/74)	MANUAL	MEFUSE	COLLECTION (STACE	ICE SIATION)	; ;
FACTOR	MIN	MAX	PTS		, <b>m</b>	CONCEPT		
WEIGHT VOLUME DEV COST TOTAL PT	334.00 22.510 5.0000	337.60	15 5.92 10 5.92 15 11.25 40 17.17	000000000000000000000000000000000000000	3.84			
RATING	00000	100.00	100 42.92	0 + •	9.76			
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NORMAL	42.92		9.76	
WE1GHT	36.14	151	8.29	
YOLUME	44.73	•36	12.95	
0EV C0ST	47.48	• 34	8 + 22	1111
		•		
;		18	ENSITIV	SENSITIVITY ANALYSIS
	"SINGLE	RATING FOR SINGLE SELECTION (BASED		EACH CONCEPT AFTER INCREASING PARAMETER VEIGHTING FACTOR BY =50 % ON 100 % MAX POINTS)
		~	6	
NORMAL	42.92	0.0	9.76	
WEIGHT VOLUME	52.82		5.68	
			•	The second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second secon

•	SELECTION MATRIX	•	(12/09/74)	•	MANUAL	REFUSE	COLLECTI	MANUAL REFUSE COLLECTION (SPACE STATION)	STATION
FACTOR	VALUE	MAX	. sta		. ~		3 .	⊢ 6. ω	
. THEIGHT	334.00	337.60	15	60.	• 1 •	.01			
J.	22.5:0	55+140	0	5.92	00.	3.64	1 .		
C057	5.0000	20.000	15	11,25	00.				
REC COST	243.03	318.30 T	15	. 10	3.54	ļ			1
TOTAL, PT	00000	020+55	55	17.36	3.70	*,	;		
RATING	00000	100.00	100	31.56	6.72	7.10	,	,	,

ORIGINAL PAGE IS
OF POOR QUALITY

C2-403

1   2   1   2   1   2   2   2   2   2				CONCEPT	
WORMAL   31.56 6.72 7.10   WEIGHT   27.77 6.04 6.30   WOLUNE   33.66 6.16 9.71   WOLUNE   33.66 6.16 9.71   WOLUNE   36.77 5.92 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   & 25 6.25   &		. <b>-</b>	~		
#EIGHT 27.77 6.C4 6.30  VOLUME 33.86 6.16 9.71  DEV COST 36.77 5.92 6.25  REC COST 27.92 8.75 6.25  REC COST 27.92 8.75 6.25  SENSITIVITY ANALYSIS  SENSITIVITY ANALYSIS  SENSITIVITY ANALYSIS  C O N C E P T  C O N C E P T  C O N C E P T  C O N C E P T  C O N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E P T  C D N C E	NORMAL	31.56	6.72		
DEV COST       36.77       5.92       6.25         REC COST       27.92       8.75       6.25         SENSITIVITY ANALYSIS         SENSITIVITY ANALYSIS         SENSITIVITY ANALYSIS         SENSITIVITY ANALYSIS         SENSITIVITY ANALYSIS         SINGLE SELECTION PARAHETER REIGHTING FACTOR BY ~50 B         (BASED ON 100 B HAX POINTS)         C O N C E P T         C D N C E P T         1       2         3       3         C O N C E P T         C D N C E P T         C D N C E P T         D N C E P T         C D N C E P T         C D N C E P T         C D N C E P T         C D N C E P T         C D N C E P T         C D N C E P T         C D N C E P T         D N C E P T         C D N C E P T         C D N C E P T         C D N C E P T         D N C E P T	WEIGHT	27.77	4.0.4	6 9.71	; ; ; ; ;
SENSITIVITY ANALYSIS  SENSITIVITY ANALYSIS  RATING FOR EACH CONCEPT AFTER INCREASING  SINGLE SELECTION PARAMETER REIGHTING FACTOR BY -50 S  (BASED ON 100 S MAX POINTS)  C O N C E P T  C O N C E P T  NORMAL 31.56 6.72 7.10  VOLUME 28.80 7.40 3.97  DEV COST 24.70 7.78 8.22	DEV COST REC COST		• ·	• •	
SINGLE SELECTION PARAMETER INCREASING  SINGLE SELECTION PARAMETER REIGHTING FACTOR BY ~50 S  (BASED ON 100 S HAX POINTS)  C O N C E P T  C O N C E P T  C O N C E P T  A 56.54 7.62 8.15  VOLUME  28.80 7.40 3.97  DEV COST 24.70 7.78  B 6.22			, s		
можнац 31.56 6.72 7.10 метсит 36.54 7.62 8.15 уоциме 28.80 7.40 3.97 DEV COST 24.70 3.97			TNG LECT	FOR EACH CONCEPT AFTER INCREASING TION PARAMETER MEIGHTING FACTOR BY +50 % ASED ON 100 % MAX POINTS)	ORIC OE.
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#EIGHT 36.54 7.62 8.15 VOLUME 28.80 7.40 3.97 DEV COST 24.70 7.78 8.22	Z S S S S S S S S S S S S S S S S S S S		6.72	7.10	E QU
	WEIGHT VOLUME DEV COST	20.0	7.62	2 6.15 0 3.97 8 8.22	ALITY SE IS

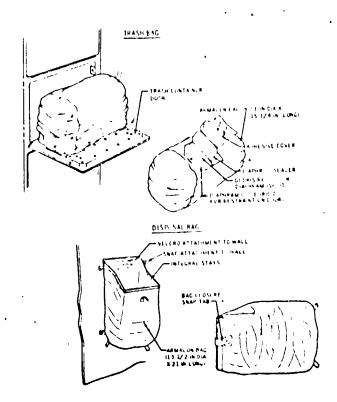
C2-404

APPLIANCE CONCEPT COMPONENT SUMMARY MATRIX APPLIANCE FUNCTION: 3.2.1-REFUSE/MANUAL COLLECTION

	<del></del>				
NUMBER OF	SAFETY CRITICAL ITEMS				
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SPACECRAFT Space Station	·······
HABITABILITY SUBSYSTEM Housekeeping	HABITABILITY FUNCTION Refuse Management
APPLIANCE FUNCTION Manual Collection	
APPLIANCE CONCEPT NO./TITLE 1/Waste/Tr	ash Bags
THDEX NO. 3.2.1.1	REF. NO. 283,203,170,297

DESCRIPTION The waste/trash bags concept employs trash bags and disposable bags for refuse collection. This concept uses the bag concept used on Skylab. The trash containers are mounted on the back side of collector doors. The collector areas are located in the food management, personal hygiene, and other areas where significant amount of bulk refuse is generated. The study assumed 15 collectors for Space Station and 3 collectors for Shuttle. Trash entry into the bag is through the front of the collection door through a slit in the bag. The refuse collection was hased on its uncompressed volume. Disposable bags were applied for uncompressible trash. The disposable bags are held during use by snaps located at various locations throughout the vehicle. Both types of bags have bag closure devices to seal the bag after filling.



# APPLIANCE CONCEPT REQUIREMENTS AND PENALTIES CALCULATIONS CONCEPT // WASI C/TRASH BAG, S

INDEX NUMBER 3.2.1.1

(FI '/MISSION)

KG/MISSION (LB/MISSION)

•		<u>LP1CAL</u>	POWER C POWE	<u>REQUIR</u>	<u>E M E N T S</u>	P O W F R
COMPONENT (REF)	USE TIME CYCLE (HR)	PEAK (WATTS)	③ AVERAGE (WATTS)	DFMA:D (WAIT-HR/ CYCIE) (DX(3)	(S) PEAK (WAITS)	(6) DEMAN AVERAGE (WATT-H (WATTS) ①X(
		MAXIMUM		TOTAL	MAXIMUM	JATOT
SOURCE		THERMAL  LATENT (BTU/HR)	SEN	REMENIS SIBLE U/HR)	HEAT LEAK (BTU/HR)	TO COOLANT (BTU/HR)
N/A		(BIO) III.)			(BIO/IN)	(61070K)
	TOTAL .	WATT (BTU/HR)	WATT	(BTU/HR)	WATT (BTU/HR)	WATT (BTU/HR)
	<u>0</u>	PERATIO THERMAL	N <u>ā</u> l <u>P</u> E	<u>NALTIES</u>		
SOURCE N/A	HEAT (BTU/HR/	LEAK T	O COOLANT U/HR/CYCLE)	ELECTRICAL (PK WATTS/CY		VOLUMÉ N) (FT <sup>3</sup> /MISSION)

C2-407

WATTS/CYCLE (BTU/HR/CYCLE)

TCTAL

WATTS/CYCLE (BTU/HR/CYCLE)

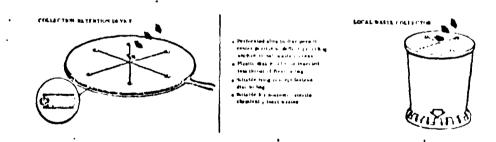
### APPLIANCE CONCEPT REQUIREMENTS AND PENALTIES CALCULATIONS (CONCLUDED)

CONCEPT I WASIC FIRMSH RINGS INDEX NUMBER 3.2.1.1

• <u>F I X E D</u>	WEIGHT/YOLUME REQUIR	<u>EMENTS</u>
COMPONENT (REF)	WEIGHT (LBS)	VOLUME (FT³)
COLLECTION DEVICE . (283	15.0	
TRASH BRGS DISMOSABLE BRGS	240.8	<u>6.37</u> 2.43
203-03/13/C BIN13		
	•	
	***************************************	
TOTAL	153.1 (337.5)	.634 (22.4)
•	• KG (LBS)	M³ (FT³)
· <u>\$0110</u> <u>Ex</u>	<u>PENDABLE WI/VOL REQU</u>	IIREMENIS
	(T) (PEF) WI/GROW LAY	VOL/UNIT (PEF) VOL/CHOLE DAY
TYPE UNITS/CYCLE(REF)	(PKG. WT/UNIT) (FEF) ① X ② (LB)	(PKG. VOL/UNIT) (FEF) (1) x 4) (FT')
TRASH BAGS 1.87	.7 (McDac) 1.309	.0185 (MeDAC) .0396
DISPOSABLE BYGS	-75 (nicons) .444	0224 Melay 0132
<del></del>		
	Σθ /.753	Σ.(s) .0478
·	20 _1.753 TOTAL WILLET	<b>\(\sum_{\text{01AL}}\) \(\frac{.0478}{\text{101AL}}\)</b>
TOTAL WT.		[146.3 [322.5]
MISSION CYCLES/DAY X	1.84 AVS/MISSION X 1.7.53 • AVS/MISSION X 1.7.54 (LB)	140.3 DEE.S
TOTAL VOI		7/0 /0 701
MISSION CYCLES/DAY X	184 AVS/MISSION X TOT VOLVEYCLE	.249 (8.79)
•	(FT <sup>3</sup> )	
C 4 5 // 1 O // 1		9
- <u>6 A S/L 1 Q U 1</u>	_	REMENIS
	O RECOVERY AMT.	RECOVER DICYCLE ANT LOST/CYCLE  (1) + (3)
TYPE (	LB) FACTOR	① x ②
-		
Σ ①		Σ⊙
TOTAL NT.		<b>,</b>
MISSION CYCLE/DAY DAYS/MI	SSTON YOTAL LOSY/CYCLE	* * kG (18)
erections entailed	(a)	₩ A (10)

SPACECRAFT Space Station	the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Co
MABITABILITY SUBSYSTEM Housekeeping	HABITABILITY FUNCTION Refuse Management
APPLIANCE FUNCTION Manual Collection	
APPLIANCE CONCEPT NO./TITLE 2/Waste R	eceptacles/Reusable
INDEX NO. 3.2.1.2	REF. NO. 170,160

DESCRIPTION The waste receptacles/reusable concept utilizes aluminum rigid trash containers with tops with perforated slits. Replaceable plastic liner bags are used for refuse transport. The containers are held to structure with steel spring-finger retainer strategically placed throughout the vehicle. The number of containers used for space station were 30 and 6 for Shuttle. The number of containers was based on the fact the collectors are at fixed locations within the vehicles. The same container was used for compressible and uncompressible refuse. The number of plastic liners provided for the concept were based on the refuse volume. The plastic liners were assumed to be changed every 5 days based on volume of .68 FT³/collector (15 liners/5 days for Space Station, .634 liners/5 days for Shuttle). The liner volume was assumed to be .27 FT³ less than container volume to allow for positive closure.



### APPLIANCE CONCEPT REQUIREMENTS AND FEMALTIES CALCULATIONS CONCEPT DUMBSEC RECEPTACLES/REVISION 15

H<sup>3</sup>/HISSION (FT<sup>3</sup>/HISSION)

(FB/MI2210M)
RENMI2710M

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MPONENT (REF)	USE THE CYCLE (HR)	(WATTS	<b>.</b> A	③ VERAGE WATTS)	(4) DEMAID (WATT-HP/ CYCLE) (1) X (1)	(5) PEAK (WATTS)	(6) AVERALE (WATTS)	DEMAN (WAT C+H (YCLE) () A (()
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							****	
		MAXIMU	JM		TOTAL	MAXIMUM		101Vf
SOURCE N/A		THERM  LATENT  (BTU/HR		SEN	REMENTS SIBLE U/HR)	HEAT LEAK (BTU/HR)	(B	COOLANT TU/PR
	TOTAL	WATT (BTU	/HR)	WATT	(BTU/HR)	WATT (BTU/HR)		(BTU/HR)
•		<u>OPERAI</u>	10 <u>n</u> 41	. <u>P</u> E	. <u>N A L I ] E S</u>			
		NT LEAK	RMAL TO COF		ELECTRICAL	WE IGHT		)LUM <sup>e</sup>
SOURCE	<b>(B</b> TU/H	R/CYLLE)	(BTU/HP/	CYCLE)	(PK WATTS/LYC	LE) (LB/MISS	ION) (FT')	MISSION)
N/A					·		<del></del>	
		<del></del>				<del></del>	<del></del>	

WATTS/CYCLE (BTU/HR/CYCLE)

TOTAL

WATTS/CTCLE (BTU/IRK/CYCLE)

#### APPLIANCE CONCEPT REQUIREMENTS AND PENALTIES CALCULATIONS (CONCLUDED)

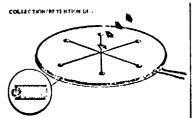
CONCEPT 2 JUNEAU PULLIFACION PLOS ABLO INDEX NUMBER 3.2.1.2. WEIGHT/VOLUME VOLUME COMPONENT PLASIC LINEKS 1.56 TOTAL M3 (FT3) KG (LBS) HIL/CHEEK DAY (LB) · GAS/L.QUID AMT. RECOVERED/CYCLE

(D.X.O)

(LB) RECOVERY AMT.USED/CYCLE(REF) **FACTOR**  $\Sigma 0$  $\Sigma$   $\odot$ KU (LB) (LB)

SPACECRAFT Space Station	
HABITABILITY SUBSYSTEM Housekeeping	HABITABILITY FUNCTION Refuse Management
APPLIANCE FUNCTION Manual Collection	
APPLIANCE CONCEPT NO./TITLE 3/Waste Ro	eceptacles/Disposable
INDEX NO. 3.2.1.3	REF. NO. 170,160

DESCRIPTION The waste receptacles/disposable concept is identical to concept 2 using disposable plastic containers. Plastic liners were not used since the disposable container provides the means of refuse transport. The disposable plastic collectors are held to the structure with plastic spring-finger retainers. The spring retainers are strategically located throughout the vehicles (30 for Space Station; 6 for Shuttle). The number of plastic collectors were based on the trash volume (2.16 per day for Space Station; .83 per day for Shuttle) based on .95 FT<sup>3</sup>/collector. The storage volume of the containers was based on a stacked configuration, i.e. like paper cup storage.



 Perforated aftin in disc permit center portion to deffect providing unidivectional wast ingress

- Planti, d sk molded or transite saw shreat of flexible ting
   Suitable tying concept fasters
- due to fait
  a Suitable for montacis, avertin,
  chemically foers wastes



# APPLIANCE CONCEPT REQUIPEMENTS AND PENALTIES CALCULATIONS CONCEPT 3/WASTO PENALTIES CALCULATIONS

INDEX NUMBER 3.2.1.3

	~		C POWE	R	D C	POWEP
MPONENT (REF)	USE TIME CYCLE (HR)	PEAK (WATTS)	(3) AVERAGE (WATTS)	DEMAND (WATT-HR/ CYCLE) () X (3)	(S) PEAK (WATTS)	6 DEMA AVERAGE (WATT- (WATTS) ① X(
•		HUHIXAM		TOTAL	MAXIMUM ,	TOTA
		,				
SOURCE .		THERMAL  LATENT  (BTU/HR)	SEN	<u>REMENTS</u> SIBLE U/HR)	HEAT LEAK (BTU/HR)	TO COOLANT (BTU/HR)
X/A						
						a sand an annual design appearable for the
	TOTAL	,				
•		WATT (BTU/HR)	WATT	(BTU/HR)	WATT (BTU/HR)	WATT (BTU/HR
			•			
		<u> </u>	HAL PE	NALIIES	<u>s</u>	
		THERMAL T LEAN TO	COOLANT	ELECTRICAL		VOLUME
SOURCE	(BTU/HF	R/CYCLE) (BTU	J/HR/CYCLE)	(PK WATTS/C	YCLE) (LB/MISSIO	N) (FT <sup>3</sup> /MISSION
N/A			<del></del>			
			```			
	<del></del>				<del></del>	

WATTS/CYCLE, (BTU/HR/CYCLE) KG/MISSION (LB/MISSION) M³/MISSION (FT³/MISSION)

NATTS/CYCLE (BIU/HR/CYCLE)

#### APPLIANCE CONCEPT REQUIREMENTS AND PENALTIES CALCULATIONS (CONCLUDED)

CONCEPT 3/WASTE PLOCPENCUES/DISADSABLE INDEX NUMBER 3.2.1.3 FIXED WEIGHT/VOLUME REQUIREMENTS WEIGHT (LBS) VOLUME (FT<sup>3</sup>) COMPONENT (REF) RETAINLES 11.10 DISPOSABLE COUTHINER 15z.5 96 TOTAL KG (LBS) M3 (FT3) W T/Y O L (PKG.WT/UNIT) VOL/UNIT (REF)
(PKG.VOL/UNIT)(REF)
(FT3) ① x ② (LB) TYPE (LB) DISPOSABLE 2.16 CONTAINER \(\sum\_{\text{101AL WT/CYCLE}}\)
\[ \sum\_{\text{101AL WT/CYCLE}} \]
\[ \text{(LB)} \] Σ (S) 1734 TOTAL VOLZCYCIE TOTAL WT. TOTAL VOL . <u>G A S/L I Q U I D</u> EXPENDABLES REQUIREMENTS AMT LOST/CYCLE AMT. RECOVEPED/CYCLE

① X ②

(LB) RECOVERY AMT.USED/CYCLE(REF) TYPE (LB) **FACTOR**  $\Sigma$  (1)  $\Sigma$  ①

KG (LE)

(z (1)

(LB)

DAYS/MISSION

HABITABILITY SUBSYSTEM 3.0	Housekeeping
HABITABILITY FUNCTION 3.2	Refuse Management
APPLIANCE FUNCTION 3.2.2	! Vacuum Collection
NUMBER OF CONCEPTS CONSIDER	RED 3

#### **ASSUMPTIONS**

1. The vacuum collection of refuse utilizes various types of vacuum cleaners. to assist in cleaning of the vehicles. A central vacuum system was not considered because sizing of the unit is dependent on the detailed vehicle configuration. The configuration was not defined well enough to size a representative system for trade purposes, therefore only hand held units were considered for the study.

2. The vacuum usage was based on 24.5 minutes per day. This was based on the following rationale.

(1 use/day) 8.5 minutes/day (1 hr/week)-general cleanup (3 uses/day) 6.0 minutes/day (2 min/meal)-meal cleanup (1 use/day) 10.0 minutes/day - emergency cleanup

24.5 minutes per day (.408 hrs/day)

S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000 S.000	STATION (SPACE STATION)		
100   111   101   111   101   111   101   111   101   111   101   111   101   111   101   111   101   111   101   111   101   111   101   111   101   111   101   111   101   111   101   111   101   111   101   111   101   111   101   111   101   111   101   111   101   111   101   111   101   111   101   111   101   111   101   111   101   111   101   111   101   111   101   111   101   111   101   111   101   111   101   111   101   111   101   111   101   111   101   111   101   111   101   111   101   111   101   111   101   111   101   111   101   111   101   111   101   111   101   111   101   111   101   111   101   111   101   111   101   111   101   111   101   111   101   111   101   111   101   111   101   111   101   111   101   111   101   111   101   111   101   111   101   111   101   111   101   111   101   111   101   111   101   111   101   111   101   111   101   111   101   111   101   111   101   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111   111	ISAGE CONSUMABLES AND PLOR REQUIREMENTS THERMAL	PBR REGIS	DEVELOPHENT
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1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000   1000	\$.000 \$.000 \$.082	0.0115.0 0.0211	
C 0 W C E F T W A M C   C 0 W C E F T W A M C   C 0 W C E F T W A M C   C 0 W C E F T W A M C   C 0 W C E W W C   C 0 W C E W W C   C 0 W C E W W C   C 0 W C W C   W C W C W C   W C W C W C W C	\$.000 .082 .082 .082 .000 .000 .000 .000	.0	1 25 55
1 - CABIN ARR (CIPCULATED), LITERS/SEC	2 2 1- 1- 1- 1- 1- 1- 1- 1- 1- 1- 1- 1- 1-		,
10	- VACUUM CLEANER (SKYLAB) - VACUUM CLEANER (CONHERICAL) - VACUUM CLEANER-VENTED TO SPAC	1 - CABIN AIR 2 - CABIN AIR 3 - OXYSEN 4 - COULING WATER 5 - MATER	LITERS/SEC NG/HR KG/HR K3/hR K3/hR K6/HR
(1) AVAILABLE (1) AVAILABLE (2) STATE OF THE ART (2) SCAE DEVELOPMENT REQUIRED (4) EXTENSIVE DEV. REQUIRED		- NITPOSEN - NITPOSEN - FPECY - WATER	KG/HR KG/HR KG/HR KG/HR
(1) AVAILABLE (2) STATE OF THE ART (2) SCHE DEVELOPMENT REQUIRED (4) EXTENSIVE DEV. REQUIRED	VAL POR QU		(***)COST INDICATOR
(4) EXTENSIVE DEV. REQUIRED	AGE		
		(4) EXTENSIVE DEV. REQUIRED	

APPLIANCE CONCEPT NO.

VACUUM CLEANER (SKYLAR)
VACUUM CLEANER (COMMERICAL)
VACUUM CLEANER-VENTED TO SPACE

80 43 PAGE 19. CONCEPT NUMBER

> Vacuum Refuse Collection (Space Station) Concept Trade C2-417

# IN	1267-4   15   14-64   14-88	VALUE FTS 1 2 3 C A M C & F T T T S 1 2 3 C A M C & F T T T T S 1 3 C A M C & F T T T T T T T T T T T T T T T T T T	1247.4   15   14.64   14.68   100   1247.4   15   14.64   14.68   100   15.00   17.00   15.00   15.00   15.00   15.00   15.00   15.00   15.00   15.00   15.00   15.00   15.00   15.00   15.00   15.00   15.00   15.00   15.00   15.00   15.00   15.00   15.00   15.00   15.00   15.00   100   100   10.62   15.00   100   100   10.62   15.00   100   100   10.62   15.00   100   100   10.62   15.00   100   100   10.62   15.00   100   100   10.62   15.30   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   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 100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100	126.74   15   1   2   3   C O M C & P T	1267-4   5   2   3   C 0 N C C P T   1267-4   14.64   14.68   100   120.40   15.00   120.40   15.00   120.40   15.00   120.40   15.00   120.40   15.00   120.40   15.00   120.40   15.00   120.40   15.00   120.40   15.00   120.40   15.00   120.40   15.00   120.40   120.40   120.40   120.40   120.40   120.40   120.40   120.40   120.40   120.40   120.40   120.40   120.40   120.40   120.40   120.40   120.40   120.40   120.40   120.40   120.40   120.40   120.40   120.40   120.40   120.40   120.40   120.40   120.40   120.40   120.40   120.40   120.40   120.40   120.40   120.40   120.40   120.40   120.40   120.40   120.40   120.40   120.40   120.40   120.40   120.40   120.40   120.40   120.40   120.40   120.40   120.40   120.40   120.40   120.40   120.40   120.40   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120.40   120.40   120.40   120.40   120.40   120.40   120.40   120.40   120.40   120.40   120.40   120.40   120.40   120.40   120.40   120.40   120.40   120.40   120.40   120.40   120.40   120.40   120.40   120.40   120.40   120.40   120.40   120.40   120.40   120.40   120.40	MAK   PTS   2 3 CONCEPT   12674   14:00	1247-4 15 1 2 3 CONCEPT 1247-4 15 14-64 14-66 .00 1703-6 15 9-02 .00 15-00 1703-6 15 7-00 15-00 1703-6 15 7-00 15-00 1703-6 15 15-00 15-00 1703-6 15 15-00 15-00 1703-6 15 15-00 15-00 1703-6 15-00 15-00 15-00 1703-6 15-00 15-00 15-00 1703-6 15-00 15-00 15-00 15-00 1703-6 15-00 15-00 15-00 15-00 1703-6 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 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15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-00 15-0	12674	1247.4   15   1	ŭ	SELECTION MATRIX		(01/19/75)	-	VACUUM	REFUSE COLLECTION (SPACE	E STATION)	
170.40 15 14.64 14.88 .00 170.40 15 9.02 .00 15.00 .86.007 10 .00 5.70 6.98 .87.88 15 7.80 .00 15.00 .99949 5 .00 2.98 1.0000 5 .00 3.65 1.0000 15 12.00 3.65 25.000 15 12.00 3.65 100.00 100 57.01 33.62 51.30	1267.4   15   14.64   14.88	1267.4 15 14.64 14.88 .00 170.40 15 9.02 .00 15.00 .66009 10 .00 5.70 6.98 .979.49 15 7.80 2.98 1.0000 5 .00 .00 3.65 1.0000 15 12.00 .00 25.000 15 12.00 .00 85.000 85 48.46 28.57 43.61	176,40 15 14,64 14,68 .00 170,40 15 9.02 .00 15.00 4,64.60 10 5.00 6.98 4,64.60 15 .00 2.98 1,00000 5 .00 2.98 1,0000 6 5.00 0.00 25,000 15 12.00 1.00 65,000 85 48,46 28,57 43,61 100.00 100 57.01 33,62 51.30	176.40 15 14.64 14.88 .00  176.40 15 9.02 .00 15.00  6.00 15 0.00 15.00  7.00 0.00 15.00  7.00 0.00 15.00  7.00 0.00 100 5.00  7.00 0.00  7.00 0.00  7.00 0.00  7.00 0.00  7.00 0.00  7.00 0.00  7.00 0.00  7.00 0.00  7.00 0.00  7.00 0.00  7.00 0.00  7.00 0.00  7.00 0.00  7.00 0.00  7.00 0.00  7.00 0.00  7.00 0.00  7.00 0.00  7.00 0.00  7.00 0.00  7.00 0.00  7.00 0.00  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2000   2000   70.02   70.02    - (2000)   2000   2000   70.02   70.02    - (2000)   2000   2000   70.02   70.02    - (2000)   2000   2000   70.02   70.02    - (2000)   2000   70.02   70.02    - (2000)   2000   70.02   70.02    - (2000)   2000   70.02   70.02    - (2000)   2000   70.02   70.02    - (2000)   2000   70.02   70.02    - (2000)   2000   70.02   70.02    - (2000)   2000   70.02   70.02    - (2000)   2000   70.02   70.02    - (2000)   2000   70.02   70.02    - (2000)   2000   70.02   70.02    - (2000)   2000   70.02   70.02    - (2000)   2000   70.02   70.02    - (2000)   2000   70.02   70.02    - (2000)   2000   70.02   70.02    - (2000)   2000   70.02   70.02    - (2000)   2000   70.02   70.02    - (2000)   2000   70.02   70.02    - (2000)   2000   70.02   70.02    - (2000)   2000   70.02   70.02    - (2000)   2000   70.02   70.02    - (2000)   2000   70.02   70.02    - (2000)   2000   70.02   70.02    - (2000)   2000   70.02   70.02    - (2000)   2000   70.02   70.02    - (2000)   2000   70.02   70.02    - (2000)   2000   70.02   70.02    - (2000)   2000   70.02   70.02    - (2000)   2000   70.02   70.02    - (2000)   2000   70.02   70.02    - (2000)   2000   70.02   70.02    - (2000)   2000   70.02   70.02    - (2000)   2000   70.02   70.02    - (2000)   2000   70.02   70.02    - (2000)   2000   70.02   70.02    - (2000)   2000   70.02   70.02    - (2000)   2000   70.02   70.02    - (2000)   2000   70.02   70.02    - (2000)   2000   70.02   70.02    - (2000)   2000   70.02   70.02    - (2000)   2000   70.02   70.02    - (2000)   2000   70.02   70.02    - (2000)   2000   70.02   70.02    - (2000)   2000   70.02   70.02    - (2000)   2000   70.02   70.02    - (2000)   2000   70.02   70.02    - (2000)   2000   70.02	120.00   12.00   14.64   14.88   .00   .10.00   .00   .10.00   .00   .10.00   .00   .10.00   .00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10.00   .10	120.00 15 10.00 15.00 15.00 15.00 15.00 15.00 15.00 15.00 15.00 15.00 15.00 15.00 15.00 15.00 15.00 15.00 15.00 15.00 15.00 15.00 15.00 15.00 15.00 15.00 15.00 15.00 15.00 15.00 15.00 15.00 15.00 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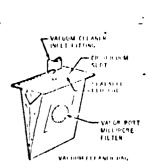
APPLIANCE CONCEPT COMPONENT SUMMARY MATRIX

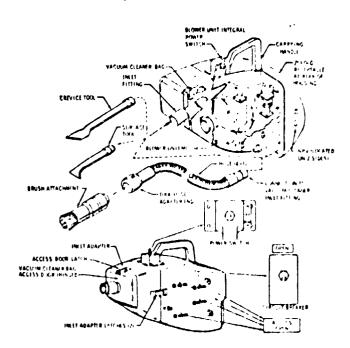
APPLIANCE FUNCTION: 3.2.2-REFUSE/VACUUM COLLECTION

NUMBER OF SAFETY CHITICAL z ш z 0 4 × 0 Ø VALVE SOLENOID SWITCH SWITCH 0 AVEAK CHECK ۲Ľ W WATER SEPARATOR ß 12 D 27 FILTER (AVCOOM) MOTOR COMPONENT TYPE PORTABLE VFCCUM CLEANER (SKYLAB) VACUUM CLEAVER VENTING TO SPACE APPLIANCE TYPE

SPACECRAFT Space Station	
HABITABILITY SUBSYSTEM Housekeeping	HABITABILITY FUNCTION Refuse Management
APPLIANCE FUNCTION Vacuum Collection	
APPLIANCE CONCEPT NO./TITLE 1/Portable	Vacuum/Electric (Skylab)
INDEX 110. 3.2.2.1	REF. NO. McDac, 297,283

DESCRIPTION The portable vacuum/electric is identical to the vacuum used on Skylab. The vacuum has a hose and pickup attachments to assist in vacuum pickup. The unit has a strap and handle for carrying/using the unit. Vacuum cleaner bags were assumed to require changing once per week (.142 cycles per day).





# CONCEPT I CINBUC VACOUM / LUCIVIC (SA YORB) INDEX NUMBER 3.2.7.1

ΕF	ECTRICAL		REQUIE	-	
USE CYCI COMPONENT (REF) (HI MOTORS (RISING) 16	LE PEAK R) (WATTS		(4) DEMAND (WATT-HP) CYCLE) ① X (3)	D C  PEAK (WATES)	POWER  O DIMM AVERAGE (HATT-) (WATTS) (DX(
	, MAXIMU		TOTAL		
•	-			·	,
	THERM	<u>REQU</u>	IREMENTS	•	
. SOURCE	LATENT (BTU/HR)		ENSIBLE BTU/HP)	HEAT LEAF	TO COOLANT (BTU/HF)
Moto?		•	262	_262	
				4	•
TATEL	WATT (BTU)		,8 (262) t (BTU/HR)	76.8 (26 8 NATT (BTU/HR)	2)
•	•			•	
	OPERAI	IONAL P	ENALIIE	5	·
	THE	RMA'	ELECTRICA		*/ <b>0</b> LUME
SOURCE (R	MEAT LEAK TU/HR/CYCLE)	TO COOLANT (BTU/HR/CYCLE)			
	,				
TOTAL	WATTS/CYCLE (BTU/HR/CYCLE)	WATTS/CYCLE (BTJ/MK/LYCLE		KG/MISSI (LB/MISSI	(N M)7M1551(N) (N) (FT?/M1551(N)

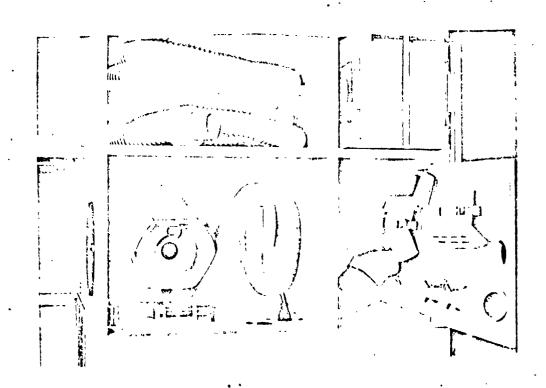
APPLIANCE CONCEPT REQUIREMENTS AND FEMALTIES CALCHEATIONS (CONCENTED)

CONCEPT 1/20/11806 VACOUM/CCCCIAIC (CATVANC) INDEX NUMBER 3.2.2.1

<u> </u>	Ē D	MEIGHT	A O Fakt	REQU	<u>JIREMEN</u>	<u>† 5</u>	
COMPONENT YACCOUNT SILLIT	(REF)	:/	(	10HT (LBS) 3020			VOLUME (FT3)
111 -CLY 144 HC565-A	1411	, <u> </u>					
ALLINGIBLATE) VACOBAL COMINE	ZZSNS	<u></u> -		.444			.03
		•				-	<del></del>
		<u></u>			<del></del>	,	
		_					
	TOTAL		13.8 KG	1 (30. (LBS)	44)	·	2 <i>5 (86)</i> n' (61')
. <u>\$0110</u>	<u>E X P</u>	<u>ENDAB</u> L	.E <u>w</u> 1/	Y <u>OLR</u>	<u>EQUIPE</u>	M F M T S	•
<b>(</b>		WT/UNII (	PEF)	(3) WT/CYCLE	VOL/	(4) UNIT (PET)	VOLZCYCLE
TYPE UNITS, CYC		(PKG. WT/UNI	T)(PEF)	(LB)	(PKG.V	OL/UNIT)(FEF) <b>(FT³)</b>	() x (4) (FT')
VACUUM		·					
CLUNNIE BAGS 1	·- <del></del> -	017	(11:)			230217	1.003067
	•		Σ0.	017 TOTAL WITCH	11	Σ 🛈	003037
TOTAL WT				(LB)			'FT')
THISSION CYCLES/DAY	X/	1 <i>94.</i> 75/MISSION =	× <sub>to</sub>	.017 11. WIZCYCLE	• 	ZC.	KG (LC) (.444)
7 11 1/1				(LB)		<b></b>	
MISSION	X — - VA	VS/MIUSION	- X10	00306 it.vol/cycle (FT)	7 •	<u></u> ooz	え7 <i>(.の</i> らう) #1 (ロリ)
· <u>G A S/L</u>	thuth		NDABL		QUIREM	F n f c	•
· 22.95.		_		? : <u>- :</u> :			<b>(1)</b>
		D YCL'(PEF) B)	REC 3	VEPY	Q AMT.RECOVEF (1) X ( (LB		AMT LOST CYCLE  (1.6)
TYPE - N/A -	٠ (١	B) ~	FAC	TOR	(LB	.)	(LE)
						-	
	<u></u>		<del></del>				
Σ ① _			•			Σ :	
TOTAL WT		, 1	•	•	•	• [	
EVCLE/LAY	DAYSYMIS	\$104 TO	ALTEUSY/CYC	(LI		z ()	AS (LB)

SPACE CRAFT Space	Station
HABITABILITY SUB	SYSTEM Housekeeping HABITABILITY FUNCTIONRefuse Management
APPLIANCE FUNCTI	ON Vacuum Collection
APPLIANCE CONCEPT	T NO./TITLE 2/Portable Vacuum/Electric (Commercial)
INDEX NO. 3.2.2.2	REF. NO. 170

DESCRIPTION The portable vacuum/electric (commercial) concept is the same as concept 1 except the unit is made of plastic and is a commercial unit operating on AC power. The unit is lighter than the concept 1 version, therefore was presented for the purposes of trade. The unit would require considerable development and was penalized for its development cost. The vacuum cleaner bags are identical to concept 1 and are replaced at the same frequency.



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APPLIANCE CONCEPT REQUIREMENTS AND PENALTIES CALCIDIATIONS

CONCEPT 2/12011BLE MICHONI/CLCTRIC COMMICRICAL)

INDEX NUMBER 3.2.2.2

#### ELECTRICAL POWEP REQUIREMENTS

		•	A	C . POWE	R	0	C POWE	
COMPONENT	(REF)	USF TIME CYCLE (HR)	② PEAK (WATTS)	③ AVERAGE (WATTS)	(4) DEMAND (WATT-HP/ CYCLE) ① X ③	⑤ PEAK (WATTS)	⑥ AVERAGE (WATTS)	(/) DEMAND (WATT-HR/ CYCLE) ① X(/)
MOTOR	<u>(17U)</u>	102	290	240	24.5		-	
								<del></del>
	<del></del> -							,
			•			<del> </del>	*****	
						<del></del>		
	<del></del>							
			240 MAXIMUM '		24.5 TOTAL	MUMIXAM	•	TOTA:

SOURCE		LATENT (BTU/HR)	SENSIBLE (BTU/I )	HEAT LEAK (BTU/HR)	TO COOLANT (BTU/HR)
MOTOR		•	546	546,	
		•		•	
		Angendalisade Angles and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second a second and a second and a second and a second and a second and a second and a second and a second and a second and a second a		-	
V	TOTAL	WATT (BTU/HR)	160 (546) WATT (BTU/HR)	160 (546) WATT (BTU/HR)	WATT (BTU/HP)

	THEAT LEAK	ERMAL TO COOLANT	ELECTRICAL	WEIGHT	<b>VOL</b> UME
<b>\$</b> OURCE	(BTU/HR/CYCLL)	(BTU/HR/CYCLE)	(PK WATTS/CYCLE)	(LB/MISSION)	(FT <sup>3</sup> /MISSION)
-N/A-		,		•	, .
	<del></del>				
<u> </u>					
		,			
. т	OTAL WATTS/CYCLE (BTU/HR/CYCLE)	WATTS/CYCLE (BTU/HR/CYCLE)		KG/MISSION (LB/MISSION)	M³/MISSION (FT³/MISSION)

W. Howell

## APPLIANCE CONCEPT REQUIREMENTS AND PENALTIES CALCULATIONS (CONCLUDED)

CONCEPT 2/FLYINGLE VACOUM/CLCCIPIC (COMMERCIAL) INDEX NUMBER 3,2.2.2.

F									0											T	
	_	_		_	_	-	 ****	 <i>-</i>	_	***	-	 		-	_	 -	-	 •	 	_	_

COMPONENT  VACOUPT CIN	(REF)	)	WEIGHT (LBS)		VOLUME (FT <sup>3</sup> ) . 293
(HICCOVING)	YOSUS NIW S) MUCL BAGS	-	,449		.03
;	TOTAL .	4.7	7 <i>3</i> (10 <i>9</i> KG (LBS)	[4]	.010 (.373) M <sup>3</sup> (FT <sup>3</sup> )
•.	<u>S O L I D</u> <u>E X P</u>		3	EQUIREMENT (4)	(5)
TYPE VACUUM	UNITS/CYCLE(REF)	WT/UNIT (PEF) (PKG.WT/UNIT)(REF) (LB)	WT/CŸCLE	VOL/UNIT (P 'PKG.VOL/UNIT (FT <sup>3</sup> )	EF) VOL/ČÝCLE )(PE; ) () Y (Å) (FT +)
CLENNER BAGS		.017 (17o)	.017	_003067	(110) .003067
	•	Σ@	)	ili -	Σ (S) - CO3 OC 7 10TAL (PT 1) (FT 1)
TOTAL WT.  MISSION "	ES/DAY DA	184 YS/MISSTON x _	0/ 7 TOT. WT/CYCLE (LB)	• [	201) (914)
TOTAL VOL _ MISSION = .14	Z ES/DAY XDA	194 YSTMISSION X	.003067	. [72	00227) MT (FTT) (CCSU)
	AMT.USED/C	D YCLE(REF)	<b>②</b> RECOVERY	QUIREMENTS  AMT.RECOVEPTD/CYCL  (LB)	<b>(</b> 1)
	, (1	В)	FACTOR	(LB)	·(LB)
	Σ①			Σ	<ul><li>(i)</li></ul>
TOTAL HTCYCLE/	x	SION NOTAL TOU	/cycle		KG (LB)

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SPACECRAFT Space Station	The state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of state of
HABITABILITY SUBSYSTEM Housekeepi	ng HABITABILITY FUNCTIONRefuse Management
APPLIANCE FUNCTION Vacuum Collect	ion ·
APPLIANCE CONCEPT NO./TITLE 3/Po	rtable Vacuum/Space Venting
INDEX NO. 3.2.2.3	REF. NO. 1022

DESCRIPTION The portable vacuum/space venting concept uses a vacuum unit vented to space. A maximum 14.7 psi delta pressure is available, however the filter required will reduce the possible suction at the pickup nozzle. The concept was tried on Apollo, but did not provide enough suction. Proper design of the hose and penetration in the vehicle shell can make this unit operational. The collection bag used in concepts 1 and 2 serves as the filter and refuse trap. The flow used was based on the concept 1; 10 CFM. Venting overboard is allowed, since the vented gas is filterd and clean.

# APPLIANCE CONCEPT PEQUIREMENTS NO PENALTIES CALCULATIONS CONCEPT 3 PORTABLE VACUUM/SPACE VENTING

INCLX NUMBER 3.2.2.3

		^		AC POW	E P	EHEHIZ EHEHIZ	POWER
OMPONENT .	(REF)	(4K) CACTE TIME	PEAK (WATTS	AVERACE	(4) DL***\0 (WATT HE/ CYCLE) (1) > (3)	(5) PEAR (WATTS)	(b) (b) (b) (b) (b) (b) (b) (b) (c) (c) (c) (c) (c) (c) (c) (c) (c) (c
			MAXIHU	- <del></del> 4	TOTAL	MAXIMUM	TATOT
			THERM	<u>AL REQU</u>	<u>I R E M E N T S</u>	<u>S</u>	
SOUR	CE		LATENT (BTU/HR		ENSIBLE BTU/HR)	HEAT LEAK (BTU/HR)	TO COOLANT (BTU/HP)
		TOTAL	WAIT (BTU,		T (BTU/HR)	WATT (BTU/HR)	WATT (BIU/HR)
				•			
			<u> </u>	10NAL P	ENALIIE	<u>\$</u>	
SOU	RCE		THE AT LEAK HR/CYCLE)	RMAL TO CODEANT (BTU/HR/CYCLE)	ELECTRICA (PK WATTS/		_
				***************************************			

# APPLIANCE CONCEPT REQUIREMENTS AND PENALTIES CALCULATIONS (CONCLUSED) CONCEPT 3/ 1512/2000 VACCOUNT/SPINCE VENTING INDEX

INDEX NUMBER 3.2.2.3

COMPONENT	(REF)		(FRZ) MEICHL		VOLUME (FT <sup>3</sup> )
<u>VACOUNT UNIT</u> (INCLUDES 1600	(SIM!)		7.0		175
ATTACHMENICS, VASOUM COUNTE	1- BHG5		.444		0,40
					•
				•	
,	TOTAL .	3.3	37 (7.44) KG (LBS)	.07	7 (255) 13 (FT3)
· <u>s</u> <u>o</u> <u>l</u>	ID EXPE	ENDABLE W		IIREMENIS	,
TYPE UNIT	O ( S/CYCLE(REF)	WT/UNIT (PEF) (PKG.WT/UNIT)(PEF) (LB)	(TB) (TB) M1/CACTE	VOL/UNIT (PEF) (PKG. VOL/UNIT)(PEF) (FT3)	(FT:)
OLUMNUK BAGS		-017 (170)	-017	-C03051(il)	) .003067
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		Σ3	O/7 TOTAL WITCHCLE	Σ.	003667
OTAL WT. WISSION CYCLES/DAY	x X ZA	3.4 ////ssign=== x	OIZ TOT. WT/CYCLE (LB)	.20	
TOTAL VOL CYCLES/DAY	XDAYS	MISSION X	101.V L/CYCLE (FT')	[.00	787 (0050) 1 (F13)
- <u>G</u> <u>A</u>	2/F I Ø ñ I ñ	<u>EXPENDAB</u>	<u> </u>	REMENIS	•
,	AMT. USED/CYC	CLE(REF)	ECUVERY	RECOVERED/CYCLE  (D) X(c)	AMT LOST/CYCLE (1) - (3)
TYPE OXYGEN		•	FACTOR A/17	(LB)	(1.8) 1.37.
. Σ	D	7	•	Σ@_	1.37
MISSION CYCLE/DAY	_ x _ <i>184</i> _ bays/missi	x /.37	. 1260	· N/A · [	571.2(12(c)

### . D2-H85(1-5

HABITABILITY SUBSYSTEM_	3.0	Housekeeping
HABITABILITY FUNCTION	3.2	Refuse Management
APPLIANCE FUNCTION	3.2.4	Refuse Processing
Number of comcepts consi	DERED	

#### **ASSUMPTIONS**

- 1. The refuse processing of refuse utilizes, compaction, shredding, incineration, and decomposition methods for processing. The shredders were combined with other processing concepts, such as compactors to increase the efficiency of refuse volume reduction. Shredders were not considered as a separate method for trash processing since it actually increases the refuse volume and requires the aid of a compactor or incinerator for reducing refuse volume.
- 2. The refuse mix used for the compressible refuse volume is summarized in Table (2-6.
- 3. The incineration and decomposition concepts 9 through 12 were considered only with shredders. Reference data indicates shredders are necessary to achieve efficient performance of these units.

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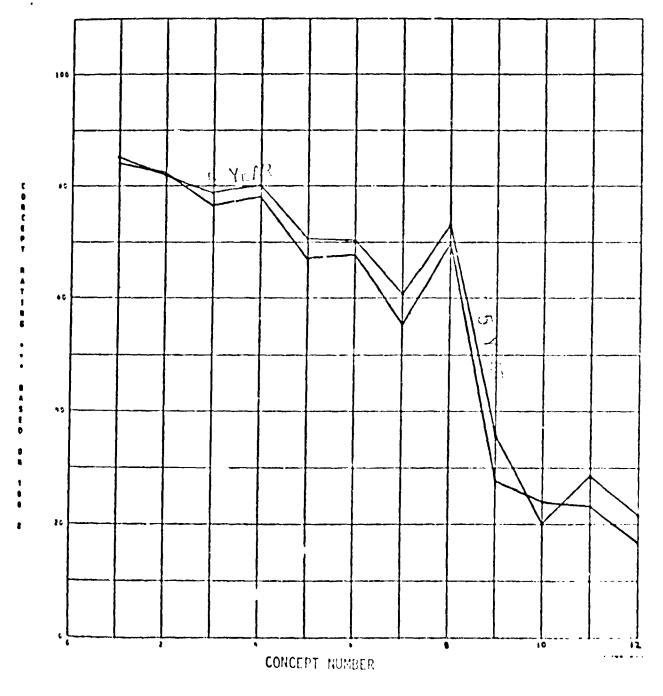
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APPLIANCE
CONCEPT
NO. CONCEPT NAME

1 - COMPACTOR-AIR PRESSURE
2 - COMPACTOR-MOTOR
4 - COMPACTOR-MANUAL
5 - COMPACTOR-MANUAL
6 - COMPACTOR-MIR PRESSURE NYSHPEDDER
6 - COMPACTOR-MIR PRESSURE NYSHPEDDER
6 - COMPACTOR-MOTOR NYSHPEDDER
8 - COMPACTOR-MOTOR NYSHPEDDER
9 - INTEGRATED VACUUM DECOMPOSTION/SHREDDER
10 - FLUSH FLO: OAYMEN INCIDENATION/SHREDDER
11 - PYROLYSIS/NATCH INCIDENATION/SHREDDER
12 - MET OXIDIZATION/ SHREDDER
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Refuse Processing (Space Station) Concept Trade

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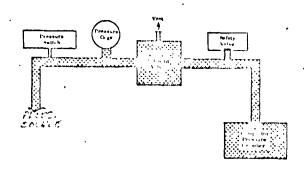
APPLIANCE CONCEPT COMPONENT SUMMARY MATRIX

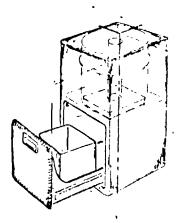
APPLIANCE FUNCTION: 3.2.4-REFUSE PROCESSING

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SPACECRAFT Space Station	
HABITABILITY SUBSYSTEM House	keeping HABITABILITY FUNCTION Refuse Managemen
APPLIANCE FUNCTION Refuse Pr	ocessing'
APPLIANCE CONCEPT NO./TITLE_	1/Compactor-Air Pressure
INDEX NO. 3.2.4.1	REF. NO. 203,123,170,270

DESCRIPTION The compactor-air pressure concept uses air pressure against a piston for refuse compaction. The compactor is used for dry and moist compactible refuse. The unit provides a sterilant to the waste to prevent bacterial growth. The refuse is placed into a waste storage bag in the compactor. The compactor is actuated and compression of the refuse is accomplished using cabin air pressure of 40 psi. The piston used for the study was 9 inches square which results in 4000# of compaction pressure. The curve (see Fig. C2-1) from reference 123 shows 30 psi is more than adequate to attain a 0.2 compression ratio. The uncompressed refuse volume per day 2.45 FT³/day, for Space Station and .947 FT³/day for Shuttle; was divided by the compactor volume of .47FT³ to determine the uses per day. Prior to tying the waste storage bag liner a sterilant capsule is placed into the bag. After tying, the capsule is broken releasing the sterilant gas.





Compression Ratio

Final Volume

Figure (2-1. COMPOSITE COMPACTION DATA FOR TRASH MIXURES

APPLIANCE CONCEPT REQUIREMENTS AND PENALTIES CALCULATIONS CONCEPT 1/COMM 10 TOM - AIR PRO-SUNC

INDEX NUMBER 3.2.4.1

	<u>ELECTPICAL</u> <u>POWER</u> <u>REQUIREMENTS</u>								
COMPONENT (REF)  YALVE  CONTINUELLE	JSE TIPE CYCLE (HR) -0167	PEAK (WATTS)	AVERAGE (WATTS)	DEMALLI (WATI-HE/ CYCLE) ① X (1)	PEAK (WATTS)  B 2	PONER  AVERAGE (WATTS)  R	(7) DEMAND (WATT-HE) CYCLE) (DX(7) -, 1,34		
			•						
· .		MAXIMUM '		TOTAL	/QMAXIMU!1	•	JG7		
	٠	<u>THERMAL</u>	R E O it 1	REMENTS			,		
. SOURCE		LATENT (BTU/HR)	SEN	SIBL!	HEAT LEAK (BTU/HR)		COOL ANT TU/HR)		
VACUE/COUTRO	14407			<u> (66 </u>	_NGG.				
	*								
`	TOTAL	WATT (BTU/HR)		CG. (BTU/HR)	MATT (BTU/HR)		(BTU/iic)		
		•							
	9	DPERATIO		NALTIE	<u>2</u>				
SOURCE M/A	HEAT (BTU/HR		TO COHLANT TU/HR/CYCLE)	ELECTRICAL (PK WATTS/C		_	OLUME /MISSION)		
<u> </u>							4, en 4000		
	TOTAL WATE		MATTS/CYCLE		KG/MISSI		USSION MISSION)		

#### APPLIANCE CONCEPT PEGALPHANTS AND FEMALTIES CALCULATIONS (CONCEPTED)

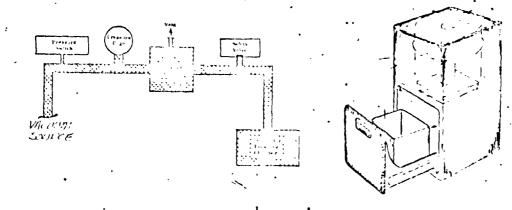
CONCEPTION WASSES BY INCOSONE INDEX NUMBER 3.2.4.1 FIXED WEILHINGLUME VOLUME COMPONENT COMPRETER (111 Core (176) MICHIGILIE MOIE ! . )\_\_\_\_\_ WIST SLOVE 1816 18/6 18 TOTAL 83 (FT.) KG (185) EXPENDABLE WI/VOL REQUIREMENTS MI/CACTE (LB) UNITS/CYCLE(REE) (LB) WASTE SEEDLE \_ 201 (170) \_ .25 (170) \_ .050f [\_21.57 [6/5.2]) Signal X - 199 X - 10T. NT/LYCLE (LB) TYCLES/DAY X 184 X 107482 [-./3/<sub>M\* (11\*)</sub> (4.6) ] REQUIREMENTS . GAS/LIQUID EXPENDABLES 0 (3) AMT.RECOVERED/CYCLE RECOVERY AMT. USED/CYCLE (REF) TYPE (LB)  $\Sigma$  ①  $\Sigma$ TOTAL TOST /LYCLE KG (LB) (LB)

(z (1)

## D2-118511 5

SPACECRAFT Space Station	
HABITABILITY SUBSYSTEM Housekeeping	HABITABILITY FUNCTION Refuse Management
APPLIANCE FUNCTION Refuse Processing.	
APPLIANCE CONCEPT NO./TITLE 2/Compacto	or-Vacuum
INDEX NO. 2.2.4.2	DEC. NO. 203 123 170 270

DESCRIPTION The compactor-vacuum concept is identical to concept I with the exception that a vacuum is used to apply the compaction pressure. The maximum pressure available is 14.7 psi, therefore, using the same size compactor, the compression ration will be 0.35. The uses per day is the same as concept I, however more bags will be used per mission due to the lower compression ratio. Cabin air is lost each time the unit is vented to vacuum. Venting overboard was allowed, since the cabin air is not contaminated.



APPLIANCE CONCEPT REQUIREMENTS AND PENALTIES CALCULATENS.

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		THERMA	•			•	
*****		LEAK	TO COOLAST	ELECTRICAL			
, <b>\$O</b> URCE	(BTU/HR/	CYCLE) (	BTU/HR/CYCLE) .	(PK WATTS/C	YCLE) (LB/MISS	ION) (FT <sup>3</sup> /M)	(22174)
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T	STAL						
•	WATTS	CYCLE	WATTS/CYCLE		KG/M155		
	(010/1	R/CYCLE)	(BTJ/HR/CYCLE)		(FB/HI22)	[64] (FT 1/MI	2211.11

APPETANCE CONCERT FEGUL PHENTS AND FEMALTIES CALCULATE NO (CONCLUES) CONCLETE / COMPACTE RESPONSE INDEX NOMBER E. E. J. J. C HELGHT/VOLUME REQUIREMENTS (LES) \_75 (fT') COMMON (1/2) (1/2) DECLEMENT (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1/2) COMMON (1 2.0 72.21 (151.2) KG (LBS) EXPENDABLE WT/YOU REQUIREMENTS #T/UNIT (FFF) (PKG WT/CNIT) (CFF) (LB) UNITS/CYCLE(FEF) 5.2 x 164 x 058 TOTAL (E1.2) CYCLES/DAY X 184 X 1008/5 (CT) GAS/LIQUID EXPENDABLES REQUIREMENTS **(?)** AMT. REC! SEFFIVEYCLE
(1) X ()
(LB) RECOVERY AMT.USED/C+CLE(REF) . FACTOR TYPE CHBIN AIR Σ① \_.036 Σ@ ...036.\_

TOTAL HT. - 5.2 x - 184 x 036 . 34.4 . N/A . [15.6. (34.4)]

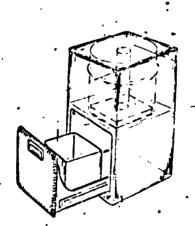
HISSTON - CYCLE/DAY - BAYS/MISS: 101/L 10. 1101/L

(CO) (18) (2.0)

## .D2-118561-5

SPACECRAFT Space Station	<del>-</del>
HABITABILITY SUBSYSTEM Housekeeping	HABITABILITY FUNCTION Refuse Management
APPLIANCE FUNCTION Refuse Processing	
APPLIANCE CONCEPT NO./TITLE: 3/Compactor	r-Motor
INDEX NO. 3.2.4.3	REP. NO. 203,123,170,270,202
	•

**DESCRIPTION** The compactor-motor concept is identical to concept 1 with the exception that a motor is used to apply the compaction pressure. The motor is a linear actuator. The compactor actuation and loading was assumed to be identical to concept 1.



## APPLIANCE CONCEPT REQUIPEMENTS AND PENALTIES CALCULATIONS CONCEPT 3/COMPACTOK-MOTOR

INDEX NUMBER 3.2.4.3

	•	A C	. POWE	R	MENIS  DC POWER			
	USE TIME	. ②	3	DEMAND	(3)	<b>6</b>	(7) DEMAI	
	CYCLE	PEAK	A-ERAGE	(WATT-HR/ CYCLE)	PEAK	AVERAGE	(WATT-I	
OMPONENT (REF)	(HK)	(WATTS)	(WATTS)	CYCLE)	(WATTS)	(ZTTAW)	①x(	
MOTOR (362)	.0167	745	715	12.4				
	<del></del>		<del> </del>	<u> </u>	<del></del>		<i>'</i> ——	
		745	•	12.4		•	•	
•	•	MAXIMUM *		TOTAL	MAXIMUM		. TOTAL	
•.		,			•		•	
	•	•	•			•	-	
		IHERMAL	REQUI	REMENTS	•	•		
		LATENT		SIBLE	HEAT LEAK		COOLANT	
SOURCE		(BTU/HR)		J/HR)	(BTU/HR)	(1	BTU/HR)	
MOTOR			16	2.5	_169.5		•	
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	······································				•	<u> </u>		
					<del></del>	··		
•	TOTAL		49.7	(169.5)	49.7(169.	51		
		WATT (BTU/HR)	WATT (	(BTU/HR)	WATT (BTU/HR)	WATI	[ (BTU/HR	
•		•			•			
		•						
•			•					
•	•	Q P E R A I 1 O M	AL PE	MALTIES				
. '		THERMAL TO	COOLANT	ELECTRICAL			VOLUME	
SOURCE	(BTU/H	R/C CLE) (BTÚ)	/HR/CYCLE)	(PK WATTS/CY	CLE) (LB/MISSI	ON) (FT	'MISSION	
- N/A -		<del></del> . <del></del>			•			
	<del>,</del>	<del></del> , <del></del>	<del></del>			<del></del>	·····	
			•					
			· - <del></del>					

C2-449

WATTS/CYCLE (BTU/HR/CYCLE) KG/MISSION (LB/MISSION) M<sup>1</sup>/MISSION (FT<sup>1</sup>/MISSION)

WATTS/CYCLE (BTU/HR/CYCLE)

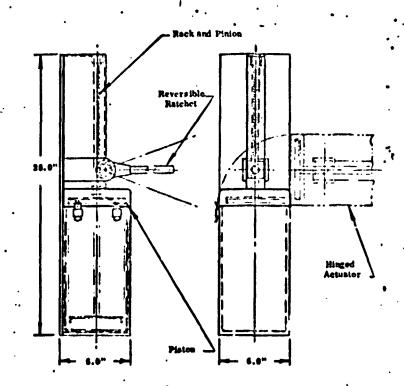
#### APPLIANCE CONCEPT REQUIREMENTS AND PENALTIES CALCULATIONS (CONCLUDED)

~ /·				
CONCEPT 3/COMPACION MOJOR	<i>j</i>		INDEX NUMBER	29.3
	;	•		

<u> </u>	M E I G H IVA O	<u>LUME REC</u>	<u> PUIREME!</u>	<u> </u>	
COMPONENT (REF)  COMPACTOR (INCLUDES (I	( <b>)</b>	WEIGHT (LBS)	•		VOLUME (FT³) 2.8
SICKLAILI AMPOLS)					
WASTE STORAGE BALLS		48.2			4.6
	***************************************			•	
	· · ·				
TOTAL .		58.15 (128	(S.Z)	.20	
	• • •	KG (LBS)			, 13 (E1.3 <sup>)</sup>
· SOLID EXP	ENDABLE	•	<u> </u>	_	(3)
TYPE UNITS/CYCLE(REF)	WT/UNIT (REF (PKG.WT/UNIT)(I (LB)	REF) ①x② (LB)		UNIT (REF) IOL/UNIT)(REF) (FT)	(1) x (4) (FT 3)
WASTE STOPAGE . 201 (170)	25. (1	74) .050	£	024 (170)	.00482
BAGS					
		26 0600		200	04/83
	. 2	101AL NT/C (LB)	YCLE	Σ⑨	YOTAL VOL/CYCLE (FT3)
TOTAL IT. S.Z. X. CYCLES/DAY DA	VS/MISSION 1	101.41/CYCLE	•	21.8	37 (18.2)
TOTAL VOL S. Z X DA	184 VS/MISS10V 1	1	2 •	.13/	(4.6)
EAS/LIQUID  AMT.USED/C  TYPE  -N/A-	D	(FT <sup>3</sup> )  DABLES R  (2)  RECOVERY  FACTOR	EQUIREM  O  ANT. RECOVER  O  (Li	) ED/CYCLE	ANT LOST/CYCLE  O-0  (LB)
Σ ο		•	-	Σ0_	
TOTAL NT. =XXXXX	<b>510N</b>	rost/cvate •	·•	· [	KG (LB)

SPACECRAFT_	Space Stat	ion		•		•	•	•
HABITABILIT	Y SUBSYSTEM	Houseke	eping <sub> </sub>	HABITABI	LITY	FUNCTION_	Refuse Mai	nagemen
APPLIANCE F	UNCTION R	efuse Pro	cessing		·			
APPLIANCE C	ONCEPT NO./	TITLE: 4	/Compactor	r-Manual				
- TAIDEN AID	3 2 1 1			DEC NO	16	50	•	

DESCRIPTION: The compactor-manual concept is a manually actuated piston refuse compactor. The manual compactor cannot be the same size as concepts 1 through 3 because of the crewman physical limitations. The concept requires a large amount of crew time because of its smaller size increases its uses per day. The design utilizes a piston actuated by a lever which contains a double acting ratchet mechanism and a pinion gear which drives a gear rack shaft. By an up and down pumping action, the piston compacts the refuse. The same waste bag weight and volume is assumed for this unit since it processed the same volume of refuse as concepts 1 through 3.



## CONCEPT 4 COMPACTOR - MINUAL

INDEX NUMBER 3.2.1.4

OMPONENT (REF)	USE TIME CYCLE (HR)	PEAK (HATTS)	AVERAGE (WATTS)	DEMAND (WATT-HR/ CYCLE) ① x ③	S PEAK (HATTS)	© AVERAGE (HATTS)	DEMA'S (WATT-H CYCLE)
			•	•			
٠.		, .	• .	TOTAL	MUMIXAM	•	TOTAL
	•	I H E R M A L.				,	
, SOURCE		LATENT (BTU/HR)	SEI	REMENIS  ISIBLE  TU/HR)	HEAT LEAK (BTU/HR)		OCLANT J/HR)
N/A							
					•	-	
۱ ۲	OTAL	MATT (BTU/HR)	MATT	(BTU/HR)	MATT (BTU/PR)	NATT (	BTU/HR)
•		• .	٠	· .		•	
		P. P. E. B. A. I. 1. Q.	NAL 21	. MALILES			
SOURCE		THERMAL IT LEAK T R/CYCLE) (B'	TO COOLANT TU/HR/CYCLE)	ELECTRICAL (PK WATTS/CY	WEIGHT CLE) (LB/MISSI		.ume ricsion)
N/A.			·				. •
			•				

TOTAL

WATTS/CYCLE (BTU/HR/CYCLE)

WATTS/CYCLE (BTU/HR/CYCLE) KG/HISSION (LB/HISSION) K'/MISSION (FT'/MISSION)

	FIXED	WEIGHT	VOLUME RE	QUIREME	NTS	
			WEIGHT			VOLUME
IMPONENT <i>PokitPIVCTOP</i> 2 (	(REF)	) 501	(LBS) <i>26,</i> 2			(FT3) 14, Z
TEXILINAT MA						
UASTE STOR			48.2			9.6
					•	
<del></del>					<del></del>	
					<u> </u>	
•			<del></del>		<del>,</del>	·
	TOTA	٠ , لـ	33.75 (	14.4)	.53	2 (18.8
<i>;</i>	•	•	KG (LBS)	<del> </del>	M	3 (FT <sup>3</sup> )
•						•
•	SOLID EX	PENDABL ②		<u>REQUIRE</u> )	<b>(4)</b>	, (S)
	Φ	WT/UNIT ( PKG.WT/UNI	(3 REF) WT/CY T)(REF) (1)X(	CLE VOL 2) (PKG.	/UNIT (REF) VOL/UNIT)(REF)	(5) VOL/CYCLE (1) X (4)
TYPE	UNITS/CYCLE(REF)	(LB) .074	(LB	7	(FT <sup>3</sup> )	① x ④ (FT³)
<u>VASTE STORAG</u>	Celiff, w		7	ZQ	00714	_00103
nGS						
						<del></del>
	•		Σ3 .010	<del>_</del>	Σ⑤	00/03
•		•	TOTAL WI	/CYCLE .	<b>∠</b> ⊌.	OO/03 TOTAL VOL/CYCL (FT3)
TAL HT.	4.5		, 10	, , -		
CYCL CYCL	<b>4.3</b> x	DAYS/MISSION	_ XOZO&	i.e	21.8	7 (48.2)
אר ארו		•	(FB)	•		
TAL VOL - 24	1.3 ES/DAY X	184 DAYS/MISSION	_ x <u>00 10</u>	<u>3</u> •	.13/	(9.6)
CTCL	ES/UAT I	# PATSSTON	TOT.VOL/CY (FT3)		• . <del>.</del>	- (+1+)
	•	•				
	. G A S/L 1 Q U 1	D EXPE	NDABLES	REQUIREM	ENTS	•
•••••		0	<b>②</b>	AMT.RECOVE	)	AMT LOST/CYCLE
<b>9</b> 110 <b>0</b>	ANT. USED,	CYCLE (REF)	RECOVERY	AMT. RECOVE ① X (L	RED/CYCLE	0-3 (LB)
TYPE N/A	•	(LB)	FACTOR	(L	3)	(LB)
				·		•
		·				<u> </u>
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•					—, ·	

### \_\_ D2-118561-5 ·

SPACECRAFT Space Station	
HABITABILITY SUBSYSTEM House	keeping HABITABILITY FUNCTION Refuse Management
APPLIANCE FUNCTION Refuse	Processing
APPLIANCE CONCEPT NO./TITLE	5/Compactor-Air Pressure w/Shredder
TNDEX NO. 3.2.4.5	REF. NO203, 123, 170, 270, 202

DESCRIPTION: The compactor-air pressure with shredder is identical to concept l with the addition of a shredder. Reference 202 stated that dry waste can be compacted more efficiently if previously shredded. Reference 123, see curve at front of appliance function section, test data does not indicate shredding will accommodate any change in compression ratio since the curve becomes asymptotic to the force line for this compactor. However, the shredder was added to the air pressure compactor for the purpose of comparison. The shredder is a commercial type used to shred paper and could with modification handle moist shredable waste. The units were based on one use for each of 3 meals, 2 scheduled cleanups, 3 spills (unscheduled), and 3 miscellaneous for paper, books, etc. The time per use was assumed to be 3 minutes. Shredding of solid wastes was not considered by this concept.

### APPLIANCE CONCEPT REQUIREMENTS AND PENALTIES CALCULATIONS CONCEPT S COMPACTOR - MIR PRESSURE WISHREDDER INDEX NUMBER 3.2.4.5

(I)

		A (	C . POWE	R	D C	POWE	R
	USE	D TIME ②	3	<b>DEMAND</b>	3	6	
	CYC		AVERAGE	(WATT-HR/	PEAK	AVERAGE	(W
COMPONENT (	REF) (HI		(WATTS)	CYCLE)	(WATTS)	(WATTS)	C
VALVE		67		39@	_8_	8_	•
CONTROLLER					2	<u>-</u>	<u> </u>
"IRDDICK MO			745	37.25			
The Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Co					<del></del>		, –
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		745	•	37.25	10	•	
	•	MAXIMUM '	•	TOTAL	MAXIMUM		1
			•		•		•
•		•					•
	•	•				•	
					•		
		THERMAL	KEGUI	REMENTS			
•		LATENT	SEN	SIBLE	HEAT LEAK	TO :	COOLA
SOURCE		(BTU/HR)		U/HR)	(BTU/HR)		TU/HF
		•					
VALVE/CONTI		******		£G	NEG.	<u> </u>	
made a man or many and	10Te 3		-	· _ ^			
SHREDDER M	OTTING.			09	_509		
SHKEDVEK III	OTTAL	• • • • • • • • • • • • • • • • • • • •		<u>07</u>	_509_		
SHKEDVEK M				<u> </u>	_509_		
SHVEDVEK III		•			_509_		
SHKEDVEK M		•					
SHVEDVER TH	TOTAL	•				  	
		MATT (BTU/HR)	149.	3(509) (BTU/HR)		,	(BTU
		WATT (BTU/HR)	149.	 3(509)	149.3(505)	,	(BTU
		WATT (BTU/HR)	149.	 3(509)	149.3(505)	,	(вти
	TOTAL	MATT (BTU/HR)	149.	 3(509)	149.3(505)	,	(вти
	TOTAL	WATT (BTU/HR)	149.	 3(509)	149.3(505)	,	(вти
	TOTAL	MATT (BTU/HR)	/49.	3(509) (BTU/HR)	149.3(5.05) WATT (BTU/HR)	,	(BTU
	TOTAL	MATT (BTU/HR)	/49.	 3(509)	149.3(5.05) WATT (BTU/HR)	,	(BTU
	TOTAL	OPERATIO!	149. WATT	3(509) (BTU/HR)	149.3(505) WATT (BTU/HR)	WATT	
	TOTAL	QPERAIIO!  THERMAL	149. HATT	3(509) (BTU/HR)  NALIIES ELECTRICAL	49.3(505) WATT (BTU/HR)	WATT	OLUME
SOURCE	TOTAL	QPERAIIO!  THERMAL	149. WATT	3(509) (BTU/HR)	149.3(505) WATT (BTU/HR)	WATT	OLUME
	TOTAL	QPERAIIO!  THERMAL	149. HATT	3(509) (BTU/HR)  NALIIES ELECTRICAL	49.3(505) WATT (BTU/HR)	WATT	OLUME
SOURCE	TOTAL	QPERAIIO!  THERMAL	149. HATT	3(509) (BTU/HR)  NALIIES ELECTRICAL	49.3(505) WATT (BTU/HR)	WATT	OLUME
SOURCE	TOTAL	QPERAIIO!  THERMAL	149. HATT	3(509) (BTU/HR)  NALIIES ELECTRICAL	49.3(505) WATT (BTU/HR)	WATT	OLUME
SOURCE	TOTAL	QPERAIIO!  THERMAL	149. HATT	3(509) (BTU/HR)  NALIIES ELECTRICAL	49.3(505) WATT (BTU/HR)	WATT	OLUME
SOURCE	TOTAL	QPERAIIO!  THERMAL	149. HATT	3(509) (BTU/HR)  NALIIES ELECTRICAL	49.3(505) WATT (BTU/HR)	WATT	OLUME
SOURCE	TOTAL	QPERAIIO!  THERMAL	149. HATT	3(509) (BTU/HR)  NALIIES ELECTRICAL	49.3(505) WATT (BTU/HR)	WATT	(BTU
SOURCE	TOTAL	QPERAIIO!  THERMAL	149. HATT	3(509) (BTU/HR)  NALIIES ELECTRICAL	49.3(505) WATT (BTU/HR)	WATT	OLUME

CONCEPT 5/CONTRACTOR AIR PROSSURE W/SHRGDOCK INDEX INDEX NUMBER 3.2.4.5

	REF)	WEIGHT (LBS)	•	VOLUME (FT³)
<u> COMPACTOR (INCLUPIS</u> STURIUANT AMPULS)		75.0		2.8
SHKEDDEK WASTE STORAGE BA	<u>.</u> ق	75.0 48.2		1.6
			•	
<u> </u>				
	OTAL .		8.2)	.255 (9.0)
	•	KG (LBS)		. И <sup>3</sup> (FT <sup>3</sup> )
`• <u>\$011D</u>	EXPENDABL (2)		REQUIREMENT (4)	
TYPE UNITS/CYCLE(R	. ② WT/UNIT (R (PKG.WT/UNIT EF) (LB)	EF) WT/CYC ()(REF) ①X② (LB)	LE VOL/UNIT (R ) (PKG.VOL/UNIT (FT <sup>3</sup> )	EF)
PASTE STORAGE .201 (	· ·	(170) .050		
AGS		<del></del>		
•	•	$\Sigma$ 3 .050	CYCLE	∑ 3 .0048.Z 101AL VOL/CYCLE
TAL HT 5.2 x	184	(LB)		(fi <sup>3</sup> ) 21.87 (48.2)
TSSTON - 5.2 x - CYCLES/DAY	DAYS/MISSION	X 0504 101. ht/cycli (LB)		KG (LB)
TAL VOL	184- DAYS/MISSION	_ x <u>0048</u> ;	z • [	131 (4.6)
CYCLES/DAY	DAYS/MISSION	TOT.VOL/CYC (FT <sup>3</sup> )	le .	Ma (FTa)
•	•			• •
<u> </u>	_	NDABLES R	EQUIREMENTS.	_
AHT.U	<pre> O SED/CYCLE(REF)</pre>	RECOVERY	(3) AMT, RECOVERED/CYCL (1) X (2)	E AMT LOST/CYCLE (D-3)
TYPE N/A '	SED/CYCLE(REF) (LB)	FACTOR	ФxØ (LB)	(rB)
		<del>*************************************</del>		
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ITAL MT.	,	٠.		

## D2-II8561-5

SPACECRAFT_	Space Station	,	· .
HABITABILITY	SUBSYSTEM Housekeeping	HABITABIL	ITY FUNCTION Refuse Management
APPLIANCE FU	NCTION Refuse Processing	9	
APPLIANCE CO	NCEPT NO./TITLE 6/Compac	ctor-Vacuum w	/Shredder
INDEX NO	3.2.4.6	REF. NO.	203,123,170, 270, 202
Z with the ac	adition of the shredder de anged from 0.35 to 0.2 bas	escribed in c	concept is identical to concept oncept 5. The compression crease of compacting efficiency

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INDEX NUMBER 3.2.4.6

	ELEC	IRICAL	POWER	REQUIRE	MENTS		
		A			D	C POW	E R
PONENT (REF	USE TIME CYCLE ) (HR)	② PEAK (WATTS)	③ AVERAGE (WATTS)	DEMAND (WATT-HR/ CYCLE) ① X ③	⑤ PEAK (WATTS)	AVERAGE (WATTS)	DEM/ (WATT- CYCLI
ALVE	.0167	•			8	B	.13
DUTROLLER	-0167				2	<u>Z</u>	.0:
HILL:DOIN MOTO	VR .05	745	745	37.25			=
		- <del></del> .		<u> </u>			·
	<del></del>		·	•		. ———	
				·			
į		745 MAXIMUM '	•	37.25 TOTAL		•	. 101/
		PARTION	•	IUIAC	PMA INUN		. 1017
•,		•					,
	. •						-
		LATENT		SIBLE	HEAT LEAK		O COOLANT
. SOURCE	LLER	LATENT (BTU/HR)	. (BT	U/HR)	(BTU/HR)		O COOLANT (BTU/HR)
. SOURCE ALVE [CONTRO! HREDDER MIC	LLER TOR_		(BT				
	LLER TDR		(BT	u/HR)	(BTU/HR)		
ALVE (CONTRO HREDDER MA	•		(BT	U/HR) (GG	(BTU/HR)		
	CLERE OTDR	(BTU/HR)	(BT	U/HR) 16-6. 	(BTU/HR)  NGG. 509	   2) _	(BTU/HR)
ALVE (CONTRO HREDDER MA	•		(BT	U/HR) (GG	(BTU/HR)	   2) _	(BTU/HR)
ALVE (CONTRO HREDDER MA	•	(BTU/HR)	(BT	U/HR) 16-6. 	(BTU/HR)  NGG. 509	   2) _	(BTU/HR)
ALVE (CONTRO HREDDER MA	•	(BTU/HR)	(BT	U/HR) 16-6. 	(BTU/HR)  NGG. 509	   2) _	(BTU/HR)
ALVE (CONTRO HREDDER MA	•	(BTU/HR)	(BT	U/HR) 16-6. 	(BTU/HR)  NGG. 509	   2) _	(BTU/HR)
ALVE (CONTRO HREDDER MA	•	(BTU/HR)	(BT	U/HR) 16-6. 	(BTU/HR)  NGG. 509	   2) _	
ALVE (CONTRO HREDDER MA	TOTAL	WATT (BTU/HR)  OPERATIO THERMAL	(BT	U/HR) (GG	(BTU/HR)  NGG.  509  199.3(50)  MATT (BTU/HR	2) HA	TT (BTU/HF
ALVE (CONTRO HREDDER MA	TOTAL	MATT (BTU/HR)  OPERATIO THERMAL	(BT	3(509) (BTU/HR)	(BTU/HR)	2) HA	TT (BTU/HF
ALVE (CONTRO HREDDER MA	TOTAL	WATT (BTU/HR)  OPERATIO THERMAL	(BT	U/HR)  (GG	(BTU/HR)	2) HA	TT (BTU/HF
ALVE (CONTRO HREDDER MA	TOTAL	WATT (BTU/HR)  OPERATIO THERMAL	(BT	U/HR)  (GG	(BTU/HR)	2) HA	TT (BTU/HI
ALVE (CONTRO HREDDER MA	TOTAL	WATT (BTU/HR)  OPERATIO THERMAL	(BT	U/HR)  (GG	(BTU/HR)	2) HA	TT (BTU/HI
ALVE (CONTRO HREDDER MA	TOTAL	WATT (BTU/HR)  OPERATIO THERMAL	(BT	U/HR)  (GG	(BTU/HR)	2) HA	TT (BTU/HF

C2-458

WATTS/CYCLE (BTU/HR/CYCLE) KG/MISSION (LB/MISSION) M3/MISSION (FT3/MISSION)

TOTAL

WATTS/CYCLE (BTU/HR/CYCLE) CONCLPT 6 CONTINUE CONCEPT REQUIREMENTS AND PENALTIES CALCULATIONS (CONCLUDED)

CONCLPT 6 CONTINUE CONCEPT 6 CONTINUE CONCEPT 6 CONTINUE CONCEPT 6 CONTINUE CONCEPT 6 CONTINUE CONCEPT 6 CONTINUE CONCEPT 6 CONTINUE CONCEPT 6 CONTINUE CONCEPT 6 CONTINUE CONTINUE CONCEPT 6 CONTINUE CONTINUE CONTINUE CONCEPT 6 CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CO

t.	i X E D W E I	लंग ४/४ ठा ग्रेंस् ह	<u>EQUIREMENTS</u>	ý
COMPONENT  COMPACTOR (INCL STEEL UINT AMPL SHELDPLE WASIE STORAGE	(5)	WEIGHT (LUS) 75 75 48.2		VOLUME (IT1) 2.8 1:6 4.6
	TOTAL	89.9 (/	98.Z)	25 <i>5</i> (9.0)
SOLI TYPE UNITS/ WASTE STOLAGE	O WI CYCLE(REF)	KG (LBS)  DABLE MIT/VOL  (O)  /UNIT (REF) MI/C .WI/UNIT)(REF) ①  (LB) (LI	REQUIREMENTS  OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTROL OF CONTR	M3 (FT3)  (5)  VOI /CTCL F  (5)  (7) X (4)  (7) X (4)
TOTAL WT	xX	∑③ .05. TOTÁL W (LI 4 x .05. SSTON TOT. WT/CYC (LB)	B) 04 * 2	
	Ф	(FT3) EXPENDABLES Ø	REQUIREMENTS  AMT. RECOVERED/CYCLE  (1)	AMT LOST/CYCLE
TYPE  N/A   D 0	AMT.USED/CYCLE(	FACTOR	Σ (i	(LB)
TOTAL MT "MISSION" CYCLE/DAY	X	TOTAL I OSTZCYCLE	(LB) (z ①	KG (FB)

## · **D2-**118561-5

SPACECRAFT Space Station	
HABITABILITY SUBSYSTEM Housekeepi	ng HABITABILITY FUNCTION Refuse Management
APPLIANCE FUNCTION Refuse Process	ing
APPLIANCE CONCEPT NO./TITLE 7/Com	pactor-Motor w/Shredder
INDEX NO. 3.2.4.7	REF. NO. 203, 123, 170, 270, 202
DESCRIPTION: The compactor-motor with the addition of the shredden de	w/shredder concept is identical to concept 3

## APPLIANCE CONCEPT REQUIPEMENTS AND PENALTIES CALCULATIONS

COMPONENT (REF)	USE YIME CYCLE (HR) .0167	PEAK (WATTS) 745 745	(3) AVERA (WATT) 74	OHE  OHE  SS)  LS  LS  LS  LS  LS  LS  LS  LS  L	REQUIRE  R  (4)  DEMAND (WATT-HR/ CYCLE)  ①X③  12.4  37.25  TOTAL  REMENIS		C P O  AVERAG (WATTS	E (WA
COMPONENT (REF)  MOTOR  SOURCE	CYCLE (HR)	PEAK (WATTS) 745 745	(3) AVERA (WATT) 74	15 15 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	DEMAND (HATT-HR/ CYCLE) ① X ③  12.4 37.25  TOTAL	S PEAK (WATTS)	6 AVERAG	E (MA CYY)
SOURCE	CYCLE (HR)	PEAK (HATTS) 745 745  1490 MAXIMUM  THERMAL LATENT	(3) AVERA (WATT) 74	15 15 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	DEMAND (HATT-HR/ CYCLE) ① X ③  12.4 37.25  TOTAL	PEAK (WATTS)	6 AVERAG	E (MA CYY)
SOURCE MDTOR		MAXIMUM  THERMAL  LATENT	REQ		TOTAL	MAXIMUN		. 70
SOURCE MOTOR		MAXIMUM  THERMAL  LATENT	REQ		TOTAL	MAXIMUM	•	. 70
SOURCE MOTOR		MAXIMUM  THERMAL  LATENT	<u>r</u> <u>e</u> q		TOTAL	MAXIMUM .		. TO
MOTOR		LATENT	REQ		REMENIS			•
MOTOR		(BTU/HR)			SIBLE J/HR)	HEAT LEAK (BTU/HR)		TO COOLAN (BTU/HR)
· ·			•		9.5	169.5		
				50		509.0		
	<del></del> -					-		
\ тот	_	WATT (BTU/HR)			2 <i>(679.5)</i> BTU/HR)	199.0(678	-	WATT (BTU/
•		•			· .	•		
	<u>0</u>	PERAILO	<u>N A L</u>	<u> P E</u>	<u>NALTIES</u>	* -		• .
•	HEAT	THERMAL 1	TO COOLANT	7	ELECTRICAL	WEIGH	f <b>T</b>	VOLUME
SOURCE	(BTU/HR/C	CYCLE) (8	TU/HR/CYCL	LE)	(PK WATTS/CYC	CLE) (1 B/MISS	(NOI	(FT³/MISSI
N/A		<del></del> , <del></del>	**************************************		-	-		<del></del>
	,	<del></del>					<del></del> .	<del> </del>

TOTAL WATTS/CYCLE (BTU/HR/CYCLE)

WATTS/CYCLE (B7Ú/HR/CYCLE)

KG/MISSION (LB/MISSION)

M<sup>3</sup>/MISSION)

APPLIANCE CONCERT REQUIREMENTS AND FEMALTIES CALCULATIONS (CONCERT)

CONCEPT T/COMMOCTOR - MOTOR WISHREDDER 1800 A NOVE 1800 A NOVER 3.2.4.7

•	•	WEICHT	QUIREMENTS	VOLUME
COMPACTOR (INCLUDE SELECUALT DISPUS SHKEDDUR	(REF) 5(1.70) i)	80 75	4	(11°) 2.8 1.6
Wisig. Stornge.	BAGS	48.2		4.6
,	TOTAL	92.17 (Zc	.2.2)	7.55 (9.0)
TYPE UNITS/CY	D NT/ CLE(REF)	① ③ UNII (REF) WT/CYC WT/UNII)(PLF) ① Y ① (LB) (LB)	CEE VOL/UNIT (REF) 2) (PYG.YOL/UNIT)(RE ) (FT1)	(11)
WASTE SICTIGE . 20 BAGS	1. ((70)	25 (170) .050	04	70)
		∑③ .050 TOTAL WI.	ρφ Σα	3 .0048Z
TOTAL MT	x _ <i>184</i> Days/hts	Sien X 0504	2/	87 (48.2)
TOTAL VOL 5.2  MISSION CYCLES/DAY	x 184 DAYS/HES	S10N X 0048		81 (4.6)
•	Φ	0	REQUIREMENIS  AMT.RECGVEPED/CYCLE	AMI TOSTATACTE
	AMT.USED/CYCLE(R	FACTOR	(LB)	(LB)
ΣΦ			Σω	
TOTAL WT.  MISSION CYCLE/DAY	T DAYS/MISSION T	X TOTAL TOST/CYCLE	(LB) (z (D)	KG (LB)

D2-H8501-5

SPACECRAFT Space Station	•,
HABITABILITY SUBSYSTEM Housekeeping	HABITABILITY FUNCTION Refuse Management
APPLIANCE FUNCTION Refuse Processing	
APPLIANCE CONCEPT NO./TITLE 8/Compacto	r-Manual w/Shredder
INDEX NO. 3.2.4.8	REF. NO. 160, 202
DESCRIPTION: The compactor-manual with	shredder is identical to concept 4 with

O

# APPLIANCE C'ICEPT REQUIREMENTS AND PENALTIES CALCULATIONS CONCEPT 8 100 MARCHOC - MINNUAL WISHRGODER

0

INDEX NUMBER 3.2.4.8

		A	C . POWE	R	D	C POL	ER
	USE TIME	② PEAK	3 AVERAGE	(4) DEMĀND (HĀTT-HP/	(5) PEAK	(6) AVERAGE	DEN (WAT)
MPONENT (REF)	(HR)	(WATTS)	(WATTS)	CYCLE)	(WATTS)	(WATTS)	CYCL
HRUDEK MOTOR	05	745	745	37.25			
							- ,
,		74'5	•	37.25 TOTAL	MAXIMUM	•	. 101
٠.			•			•	•
		<u>THEPMAL</u>	R F O U 1 I	REMENTS			•
	,	LATENT		SIBLE	HEAT LEAK		TO COOLANI
. SOURCE		(STU/HR)	(BTI	U/HR)	(BTU/HR)		(BTU/HR)
HELDOUR MO	TOR		5	09_	509		
HRIDDER MO	TOR.			09	509		
HREDDER MO	TOR.			<i></i>	509	•	
HRIDDER MO	TOR.			69	509		
HREDDEZ MO	TOTAL	WATT (BTU/HR)	149.		509 - - - - - - - - - - - - - - - - - - -		ATT (BTU/H
	-	MATT (BTU/HR)	149.	 3(559)	149.3(50		ATT (BTU/H
	-	WATT (BTU/HR)	149.	 3(559)	149.3(50	   29)	ATT (BTU/H
	-	WATT (BTU/HR)	/49.	 3(559)	149.3(50		ATT (BTU/H
	TOTAL	PERATIO!  THERMAL LEAK	/49.	3(509) (BTU/HR)	L49.3(50) MATT (BTU/HR	ıτ	*VOLUME
	TOTAL	PERATIO!  THERMAL LEAK	MAL RE	3 (509) (BTU/HR)  MALILES ELECTRICAL	L49.3(50) MATT (BTU/HR	ıτ	*VOLUME
	TOTAL	PERATIO!  THERMAL LEAK	MAL RE	3 (509) (BTU/HR)  MALILES ELECTRICAL	L49.3(50) MATT (BTU/HR	ıτ	*VOLUME
	TOTAL	PERATIO!  THERMAL LEAK	MAL RE	3 (509) (BTU/HR)  MALILES ELECTRICAL	L49.3(50) MATT (BTU/HR	ıτ	VOLUME FT <sup>3</sup> /HISSIO

MATTS/CYCLE (BTU/HH/CYCLE) KG/MISSION (LB/MISSION) MyMISSION (FT/MISSION)

WATTS/CYCLE (BTU/HR/CYCLE)

CONCERT BLOWNPHOTOR	LIANCE CONCEPT REG MANUAL CO	OD EPENTS AND FEW D <b>/S//REDUC!</b>	ities (a) ( 1) C		FR 3,2,4.8.
<u>1</u>	IXED WELL	ен 1/х огам б		<u>EMENTS</u>	•
COMPACTOR INCOME.	(REF) D.C.S(1 <b>6</b> 0) C.S.J		our 85) 6.2		VOLUME (FT') 14.2
SHKEDDUK. WASTE STOCKER			5,4 <u> </u>		4.6
				a grape pe grape and received received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and received and r	
•	TOTAL	h	7 (149.4)	.5	78 (20.4)   n' (11')
2 o i 1	D <u>EXPEND</u>	ABLE WT/Y		U L P E M F N T S	•
TYPE UNITS/ WASTE STORAGE I	CYCLE(PEF)	untt (REF) wt/unit)(REF) (LB) 2747	(1) (1) (1,0) (1,0) (1,0)	VOL/1911 (REF) (PKG.VOL/1911)(REF (FT.)	VOL/CYCLE ) (1x4) (1x3)
Biris		n andrews of the order of the second of			
	-		***** ********************************		
		<b>ا</b> الله الله الله الله الله الله الله ال	OJOS OTAL WIZLYCLE (LB)	<b>Σ</b> ઉ	TOTAL VOL/CYCLE (FT')
MISSION 24.3	x 184 DAYS/MIS	ston X	NI/CYCLE (LB)	2/.8	37 (48. 2) ) kg (lb)
MISSION 24.3	x 184	ston x for	0/03 .VOL/CYCLE (FT <sup>3</sup> )	· ./3	(4.6)
G <u>A</u> <u>S</u>	Vrīdāj <u>ē</u>	X P E N O A B L E	S REQU	<u>LREMENTS</u>	.·· •
TYPE	AMT.USED/CYCLE(R	EF) RECOV FACT	ERY AMT	.RECOVERFO/CYCLE () X (?) (LB)	AMT LOST/GYCLE (LB)
<i>N_/A</i>					
Σψ				ΣΘ	
TOTAL NT.	X	I Salvil Laurieren	, •		7) 3

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SPACECRAFT Space Station

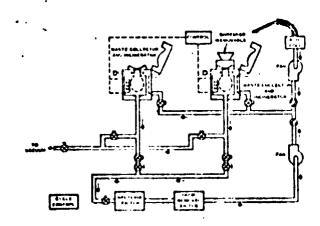
HABITABILITY SUBSYSTEM Housekeeping HABITABILITY FUNCTION Refuse Management

APPLIANCE FUNCTION Refuse Processing

APPLIANCE CONCEPT NO./TITLE 9/Integrated Vacuum Decomposition/Shredder

INDEX NO. 3.2.4.9 REF. NO. 100, 250

DESCRIPTION: The integrated vacuum decomposition/shredder concept utilizes vacuum and high temperature to decompose the refuse materials into gaseous products which can be exhausted to vacuum. The shredder is required to expose more refuse area to increase the decomposition efficiency. The chamber requires cooldown period. The process does not require oxygen; however, requires power to sustain the chemical process for 21 hours. Two units were assumed based on the refuse volume and the 12-hour cooldown time required by the unit (one unit can be used once per day). Incinerable collection bags with a hydrophobic patch were used to eliminate the maintenance and microbiological problems of filter replacement, since clogging is not anticipated with collection bags which are replaced every 24 hours. The residual ash was not considered as a concept penalty.



#### APPLIANCE CONCEPT REQUIREMENTS AND PLNALTIES CALCULATIONS CONCEPT 9 /11110 PRATED VACOUM DECOMPOSITION / SHELDOUR INDEX NUMBER 3. .4.9 ELECTRICAL POWER REQUIREMENTS POWER DEMAND (WATT-HR/ CYCLE) (1) X (3) (7) DEMALD (WATT-HR/ USE TIME 2 3 (3) **⑥** CYCLE PEAK AVERAGE PEAK AVERAGE CYCLE) (HR) (WATTS) COMPONENT (REF) (WATTS) (WATTS) (WATTS) ① × ① COLLECTION UNIT (170) 12 1400 1400 MAX I MUM TOTAL MAXIMUM TOTAL THERMAL REQUIREMENTS LATENT SENSIBLE HEAT LEAK TO COOLANT SOURCE (BTU/HR) (BTU/HR) (BTU/HR) (BTU/HR) 4760 4760 COLLECTION UNIT (100) 1396 (4760) TOTAL WATT (BTU/HR) WATT (BTU/HR) WATT (BTU/HR) WATT (BTU/HR) PENALTIES OPERATIONAL THERMAL TO COOLANT (BTU/HR/CYCLE) ELECTRICAL WEIGHT VOLUME SOURCE (PK WATTS/CYCLE) (LB/MISSION) (FT3/MISSION)

TOTAL WATTS/CYCLE (BTU/HR/CYCLE) WATTS/CYCLE (BTU/HR/CYCLE) M<sup>3</sup>/MISSION (FT<sup>3</sup>/MISSION) KG/MISSION (LB/MISSION)

APPLIANCE CONCEPT REQUIPEMENTS AND FERRALTIES CALCULATIONS (CONCEDDED)

CONCEPT 9/11/17/GRATUD VACUUM DECOMPOSITION/SHEEDDER INDEX NUMBER 3.2.4.9

	ĒĪXED W	E I C H T/V O L U M	E REQUER	F W E W I Z	ý
MITONENI OLLGOTION	(REI) UNIT_(100) BAGS		WEIGHT (185)		VOLUME (113) -63,5
0668710sL	_b/165			and and a second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second	<i>.11:</i> 9
		-		•	
				anguagnatus der des States der des	
	TOTAL	+	.8 (270.7) G (LBS) ,	[ 2.1	/3 (75.4) n³ (ft³)
	SOLIO EXPE	ENDABLE W	T/Y OF BE OF T	LREMENTS	<b>(S</b> )
TYPE	UNITS/CYCLE(REF)	WT/UNIT (REF) (PKG.WI/UNIT)(REF) (LB)	③ WT/CYCLE ① X ② (LB)	VOL/UNIT (REF) (PKG. VOL/UNIF)(REF) (FT3)	(113) (1) x (4) (2) \CACTE
AGS.	(100)	.255 (ióo)	255	.0323 (100	.0323
		Σ③	.255 TOTAL WITCYCLE	ΣΘ	O323
AL WT	~~ <i>(</i>		(LB)		(FT')
	Z / DAYS	MISSION X	TOT.WI/CYCLE (LB)	L7 <u>.6</u>	kg (i b) (93.7)
TAL VOL.	Z CLES/DAY X /A	84 x	.0323 ** TOT.VOL/CYCLE (FT3)	.3,	37 (17.9)
•	C A S/I T O II T O	<u> </u>	LES DEOU!	REMENIS	. •
TYPE	G A S/L 1 Q U 1 D  AMT. USED/CY( (LB)	) CLE(REF) RE		RECOVERED/CYCLE ① X ② (LB)	AMT LOST/CYCLE  O-(3) (LB)
	Σ Φ			ΣΦ	
TAL WT.	<u> </u>	¥	•		· · · · · · · · · · · · · · · · · · ·
CACFI	EZDAY DAYSYMISSI	10017/01 ************************************	YCLE (LB)	(z (f)	KG (LB)

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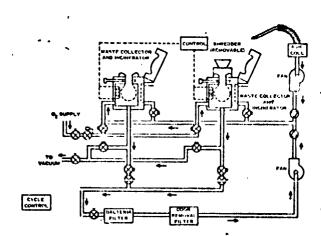
HABITABILITY SUBSYSTEM Housekeeping HABITABILITY FUNCTION Refuse Management

APPLIANCE FUNCTION Refuse Processing

APPLIANCE CONCEPT NO./TITLE 10/Flush Flow Oxygen Incineration/Shredder

INDEX NO. 3.2.4.10 REF. NO. 100, 250

DESCRIPTION: The flush flow oxygen incineration/shredder concept utilizes a continuous oxygen flow to the collection chamber for the 12 hours required for incineration. The refuse is collected/shredded and inserted into the chamber, sealed in the chamber (no vent to vacuum), heat is applied for a specified time period. The resulting sterilized/vaporized gas and vapors are exhaust to space. The valve is left open and heat is applied to bring the incineration temperature to  $1000^{\circ}$ F, while a controlled flow of oxygen is continuously supplied to the chamber. The incineration process takes approximately 12 hours with 97 to 99 percent reduction in refuse volume. Twelve hours are allowed for cooldown requiring two units per vehicle. The collection bags described in concept 9 are also used for this concept.



# APPLIANCE CONCEPT DEQUIREMENTS AND PERMETTES CALCULATIONS CONCEPTION FLOW OXYGUN INCINCRIMICAL SHREDDER INDEX NUMBER 3.2.4.10

Ü

			OWER POWE	REQUERI R	EMENTS DC	P 0 s	1 E R
COMPONENT (REF)	USF_ 11MF CYCLF (HR) (OO)[2	② PEAK (WATTS) .1000	AVERAGE (WATTS)	DEMAND (WATT-HR/ CYCLE) ① X ③	(5) PEAK (WATTS)	(6) AVERAGE (WATTS)	()) DEPARD (WATT-HR CYCLE) (I) X (/)
		4000					
•				TOTAL	MUMIXAM		TOTAL
		THERMAL	BEONI	<u>REMENIS</u>			
SOURCE		LATENT (BTU/HR)		SIBLE J/HR)	HEAT LEAK (BTU/HR)		TO COOLANT (BTU/HR)
COLLECTOR UNI	(I (100)		_3s	F10	3410	 	
	TOTAL	WATT (BTU/HR)	1000 WATT (	) <i>(3410)</i> BIU/HR)	10064 WATT (BTU/HR)	-	ATT (BTU/HR)
•					_		
	. 9	<u>DPERATION</u>	AL PE	NALTIES	<u>i</u>		
SOURCE	HFAT (BTU/HR	THERMAL T LEAK TO /CYCLE) (BTU	COOLANT /HR/CYCLE)	ELECTRICAL (PK WATTS/C)		ON) (	VOLUME (FT <sup>3</sup> /MISSION)
<i>N/A</i>							

KG/MISSION)

(L1./W12210N W./W12210N

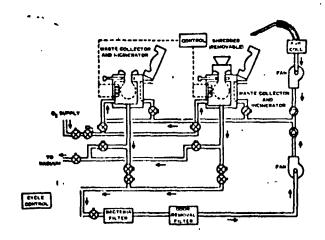
WATTS/CYCLE - WATTS/CYCLE (BTU/HR/CYCLE) (HTU/HR/CYCLE) APPLIANCE CONCERT REQUIREMENTS AND PERMITTES CALCULATIONS (CONCERDED)

CONCERT 10/FLOSH FLOW OXYGEN INCINCRATION/SIRREDDER INDEX NUMBER 3, 2,4.10

OMPOYENT BOLLECTION	UHIT.	(REF) (100)	e partie destruite de suit suite suite	WEIGHT (LBS) 186		,	VOLUME (FT1) -61.6
POLLECTION				93.7			
					,		
		TOTAL	/2	26.9 (Z KG (LBS)			.05 (72.5)
TYPE	S Q L 1 D  ON 115/CYCL	W (PKI	DABIE  T/UNIT (REF) G. WT/UNIT)(RE  (LB)	(3 WT/ Y	) CLE	REMENTS  OUT  OUT  OUT  OUT  OUT  OUT  OUT  O	\$ \\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\
COLLECTION BAGS		(100)	.255 (/	ēo) .25	<b>S</b>	.0323 (1	m) ,0323
TAL NT.				(3) 255 TOTAL WI	i)	Σ	(FT3)
TAL VOL			4 15510N X 15510N X	255 TOT.WI/CYC (LB) 			2.5 kg (lb) (93.7) 137 M <sup>3</sup> (f <sup>33</sup> )
TYPE	<u>G A S/L 1</u>	① IT.USED/CYCLE (I.B)		② RECOVERY FACTOR	(	O D x Ø (LB)	(1)-(3) (LB)
OXYGEN		1.283		_ <i>N/A</i>		!/A	
	Σ ①	1.283				Σω	1.203
OTAL WY DISSION CYCLE/	DAY'X-	184 Days/Mission	101AL 10	SIZUTULE	472 ·	1,28 ·	Z14.7 (473.3)

SPACECRAFT Space Station	
HABITABILITY SUBSYSTEM Houseke	eping HABITABILITY FUNCTION Refuse Management
APPLIANCE FUNCTION Refuse Pro	cessing
APPLIANCE CONCEPT NO./TITLE]	1/Pyrolysis/Batch Incineration/Shredder
INDEX NO3.2.4.11_	REF. NO. 100, 250

DESCRIPTION: The pyrolysis/batch incineration/shredder concept utilizes a three-step process to minimize oxygen consumables. The shredded refuse is heated to 250°F and held at this temperature for 30 minutes to ensure sterilization. The vent valve is then opened and the water is flashed to space as a vapor. The chamber is then heated to 1200°F, with the vacuum valve remaining open, and the wastes are pyrolytically decomposed (vacuum decomposition) and the gases are vented to space. At the end of the pyrolysis process, the vent valve is closed, the chamber is charged with oxygen, and several batch incinerations are performed. The batch incineration step also reduces the ash residue from 12 to 2 percent of the total wastes processed. After final venting to space, the chamber cooldown takes 12 hours. The pyrolysis/batch incineration process is identical to the schematic shown for concept 10. The pyrolysis/batch incineration takes 12 hours. The collection bags described in concept 9 are also used for this concept.



# D2-118561-5

## APPLIANCE CONCEPT REQUIREMENTS AND PENALTIES CALCULATIONS

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					the same of the same		
		MUMIXAM		TOTAL	MAXIMUM		TOTAL
OCLECTION UN	[[_([00]		4				
COLECTION UN	//(/. <del></del>				• =	and the same of	
COLLECTION UN	//(/ <i>0</i> 0)						
COCLECTION UN				(4760)	1396(47		
COLLECTION UN	TOTAL	WATT (BTU/HR)	1396	(4760) BTU/HR)	1396(47) WATT (BTU/HR)	(60) WATT	(BTU/HR)
COLLECTION UN	TOTAL	WATT (BTU/HR)	1396	•	-	(60) HATT	(BTU/HR)
COLLECTION UN	TOTAL	WATT (BTU/HR)	1396	•	-	(60) HATT	(BTU/HR)
COLECTIONUN	TOTAL		1.396 WATT (	BTU/HR)	WATT (BTU/HR)	(60) HATT	(BTU/HR)
COLLECTIONUN	TOTAL	WATT (BTU/HR)  PERATION THERMAL	1.396 WATT (	•	WATT (BTU/HR)		(BTU/HR)

(LB/MISSION)

(FT3/MISSION)

WATTS/CYCLE'
(BTU/HR/CYCLE)

TOTAL

WATTS/CYCLE (BIU/HR/CYCLE)

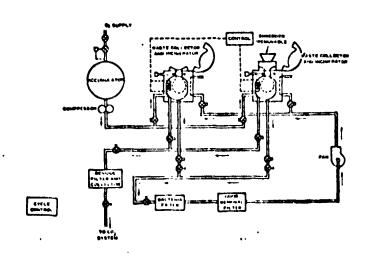
APPLIANCE CONCEPT REQUIREMENTS AND PENALTIES CALCULATIONS (CONCLUDED)

CONCEPT 11/PYROL 4515/BATCH INCINCRATION/SHEEDDER INDEX NUMBER 3.2.4.11

	<u> </u>	<u>0</u> !	HEIGH	I/X O F ñ	ME REQU	IREMEN	<u>T S</u>	
COMPONENT COLLECTION	111117 •	(REF) (100			WEIGHT (LBS) 186		. 4	VOLUME (FT3) 53
COLLECTION	BAGS		:	**************************************	93.7			1.9
		<del></del>	•				•	
			· ·					
			•					
i	•	TOTAL		126	.9 (279. KG (LBS)	7)	1.6	Z (57.2)
•	<u> </u>	EXP	ENDA	BLE W		<u>EQUIRE</u> !	<u> enis</u>	• •
TYPE	(I) UNITS/CYCLE	(REF)	(PKG.WT/	② T (REF) UNIT)(REF) LB)	MT/CYCLE ①x② (LB)	(PKG.VI	(REF) DL/UNIT)(REF) (FT³)	\$\\ \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \( \) \(
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	Σ 0 _	.37	6	-	•		Σο	.376
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SPACECRAF"	T Space Station			
HABITABIL:	ITY SUBSYSTEM House	keeping HABITABILI	ry FUNCTION_	Refuse Managemen
APPLIANCE	FUNCTION Refuse P	rocessing	<del></del>	
APPLIANCE	CONCEPT NO./TITLE_	12/Wet Oxidization/Shr	edder	
INDEX NO.	3.2.4.12	REF. NO.	100, 250	

DESCRIPTION: The wet oxidization/shredder concept is a moderate temperature, high pressure catalytic process. The system employs an insulated chamber similar to the incineration and decomposition concepts. Shredded refuse treatment is accomplished by charging the chamber with 500 psia oxygen at ambient temperature and applying heat to bring the chamber up to oxidation temperature. The final pressure and temperature are approximately 1750 psia and  $500^{\circ}F$ . The advantage of the wet oxidation process is the production of water which can be processed and reused in the spacecraft. The system requires a high pressure oxygen source, assumed in this study as a compressor. A stirrer would enhance the wet oxidation process, but was not considered in this study due to lack of engineering data. Based on two data sources, the process was assumed to take 21 hours, most of which is cooldown time ( $10^{12}$  to 6 hours). The collection bags described in concept 9 are also used for this concept.



## D2-118561-5

APPLIANCE CONCEPT REQUIPEMENTS AND PENALTIES CALCULATIONS CONCEPT/2/WET OXIDIZATION/SHEEDDER

INDEX NUMBER 3.2.4./2

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SOURCE	HEAT (BTU/HR		COOLANT HR/CYCLE)	ELECTRICAL (PK WATTS/CYC	MEIGHT (LB/MISSION		olume /mission
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707/	u	S/CYCLE WAT			KG/MISSION		MISSION

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APPLIANCE CONCEPT REQUIREMENTS AND PENALTIES CALCULATIONS (CONCLUDED)

CONCEPT 12 WET OXIDIZATION/SHREDUER

INDEX NUMBER 3.2.4.12

•	FIXED	MEIGHT/YOL	IME REQUIR	EMENIS	
COMPONENT	(REF)	•	WEIGHT		VOLUME
			(LBS)		(FT <sup>3</sup> )
COLLECTION		<i></i>	526.5	<del></del>	74.3
COLLECTION	N BAGS	***************************************	93.7		11.9
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	-	MT/UNIT (REF)	(3) WT/CYCLE	VOL/UNIT (REF)	VOL/CYCLE
	Œ	(PKG.WT/UNIT)(REF)	<b>්</b> ර්ද්රී	(PKG.VOL/UNIT)(REF	) (1) (1)
TYPE	UNITS/CYCLE(REF)	(LB)	OXO (LB)	(FT³)	)
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			•	•	
	•	$\Sigma$	1255	ΣΘ	0323
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•			(LB)		(FT <sup>3</sup> )
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TOTAL VOL					
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HABITABILITY SUBSYSTEM 3.0	Housekeeping
HABITABILITY FUNCTION 3.2	Refuse Management
APPLIANCE FUNCTION 3.2.5	Refuse Disposal
<b>NUMBER OF C</b> ONCEPTS CONSIDER	ED3

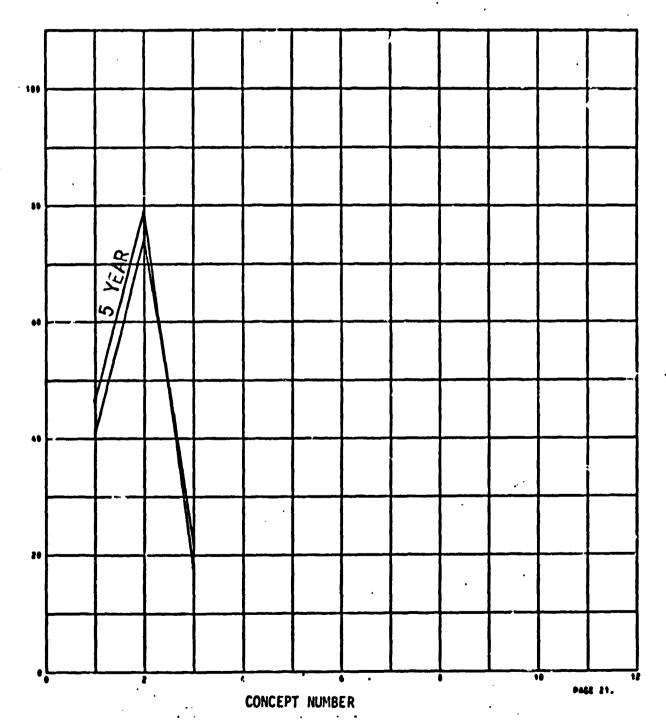
#### **ASSUMPTIONS**

- (1) Refuse disposal includes concepts most likely to be used on near term spacecraft. The concepts consider vacuum storage, static onboard storage, and jettison to earth for aerodynamic incineration. Disposal of refuse using rockets to the sun was not used, since radioactive wastes were not considered by the study.
- (2) The refuse volume and weight is based on the tabulation on Table C2-6.
- (3) The uncompressed volume of trash was used to size all of the concepts.

CABIN AIR (CIRCULATED), LITERS/SEC (FT <sup>3</sup> /MIN)  COOLING MATER (CIRCULATED), LITERS/SEC (FT <sup>3</sup> /MIN)  COOLING MATER (CIRCULATED), LITERS/SEC (FT <sup>3</sup> /MIN)  COOLING MATER (CIRCULATED), LITERS/SEC (FT <sup>3</sup> /MIN)  COOLING MATER (CIRCULATED), LITERS/SEC (FT <sup>3</sup> /MIN)  COOLING MATER (CIRCULATED), LITERS/SEC (FT <sup>3</sup> /MIN)  COOLING MATER (CIRCULATED), CACHR (LE/HR)  WATER  (CIRCULATED), CACHR (LE/HR)  COOLING MATER (CIRCULATED), CACHR (LE/HR)  WATER (CIRCULATED), CACHR (LE/HR)  WATER (CIRCULATED), CACHR (LE/HR)  FREON  (CIRCULATED), CACHR (LE/HR)  WATER (CIRCULATED), CACHR (LE/HR)  FREON  (CIRCULATED), CACHR (LE/HR)  COOLING MATER (CIRCULATED)  KG/HR (LE/HR)  COOLING MATER (CIRCULATED)  KG/HR (LE/HR)  FREON  (CIRCULATED)  COOLING MATER (CIRCULATED)  KG/HR (LE/HR)  COOLING MATER (CIRCULATED)  KG/HR (LE/HR)  CACHR (CIRCULATED)  KG/HR (LE/HR)  COOLING MATER (CIRCULATED)  KG/HR (LE/HR)  COOLING MATER (CIRCULATED)  KG/HR (LE/HR)  COOLING MATER (CIRCULATED)  KG/HR (LE/HR)  COOLING MATER (CIRCULATED)  KG/HR (LE/HR)  CACHR (CIRCULATED)  KG/HR (LE/HR)  CACHR (CIRCULATED)  KG/HR (LE/HR)  COOLING MATER (CIRCULATED)  KG/HR (LE/HR)  COOLING MATER (CIRCULATED)  KG/HR (LE/HR)  CACHR (CIRCULATED)  KG/HR (LE/HR)  CACHR (CIRCULATED)  KG/HR (LE/HR)  CACHR (CIRCULATED)  KG/HR (LE/HR)  CACHR (CIRCULATED)  KG/HR (LE/HR)  CACHR (CIRCULATED)  CACHR (CIRCULATED)  KG/HR (LE/HR)  CACHR (CIRCULATED)  KG/HR (LE/HR)  CACHR (CIRCULATED)  KG/HR (LE/HR)  CACHR (CIRCULATED)  CACHR (CIRCULATED)  CACHR (CIRCULATED)  CACHR (CIRCULATED)  CACHR (CIRCULATED)  CACHR (LE/HR)  CACHR (CIRCULATED)  CACHR (LE/HR)  CACHR (CIRCULATED)  CACHR (LE/HR)  CACHR (CIRCULATED)  CACHR (CIRCULATED)  CACHR (CIRCULATED)  CACHR (CIRCULATED)  CACHR (CIRCULATED)  CACHR (CIRCULATED)  CACHR (CIRCULATED)  CACHR (CIRCULATED)  CACHR (CIRCULATED)  CACHR (CIRCULATED)  CACHR (CIRCULATED)  CACHR (CIRCULATED)  CACHR (CIRCULATED)  CACHR (CIRCULATED)  CACHR (CIRCULATED)  CACHR (CIRCULATED)  CACHR (CIRCULATED)  CACHR (CIRCULATED)  CACHR (CIRCULATED)  CACHR (CIRCULATED)  CACHR (CIRCULATED)  CACHR (CIRCUL		CONSUMBILES AND FLOW	Me feet	REQUIRENTS	46475	1469H1	THEFAS, REGATS	the is	CLES pos atouts	81/VOL			DEVeloPHENT COST	
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APPLIANCE CONCEPT FUNCTION NATRIES

STORAGE HIN/CONTAINER
SOLID PROPELLANT REFUSE ROCKET --



Refuse Disposal (Space Station) Concept Trade

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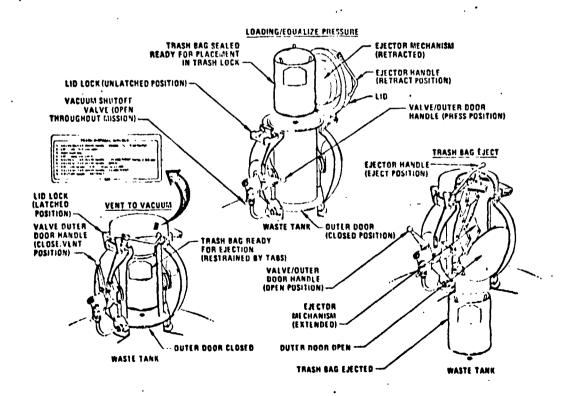
APPLIANCE CONCEPT COMPONENT SUMMARY MATRIX

APPLIANCE FUNCTION: 3.2.5-REFUSE DISPOSAL

SAFETY CRITICAL ITEMS R r z w z 0 ۵ Σ 0 ပ 0 œ œ X МОТОР ИЗТІИВІ UNK z ROCKET MOTOR B VALVE **AOTAUTOA** COMPONENT TYPE STORAGE BIN/CONTAINER/RESTORAGE/ BIOLOGICAL STABILIZED SOLID PROPELLANT REFUSE ROCKET WACLUM STORAGE/RESTORAGE/ BIOLOGICAL STABILIZED APPLIANCE TYPE

SPACECRAF	Space Station			
HABITABIL:	ITY SUBSYSTEM House	keeping HABITABIL	ITY FUNCTION_	Refuse Management
APPLIANCE	FUNCTION Refuse D	isposal ·		
APPLIANCE	CONCEPT NO./TITLE	1/Vacuum Storage		
INDEX NO.	3.2.5.1	REF. NO.	MacDac, 283	, 297

DESCRIPTION: The vacuum torage concept considered was the same as used for Skylab. The Skylab airlock was used as the means to deposit refuse into the vacuum storage tank. The vacuum environment stops bacterial growth in the refuse. The internal volume of the airlock is 4.3 ft<sup>3</sup> and was used to calculate the cabin air lost during each airlock refuse disposal cycle. The vacuum container was assumed to be a 10.4 foot diameter spherical tank fabricated of 6001 aluminum. The 10.4 foot diameter tank can be accommodated in both the Space Station and the Shuttle payload bay. Aluminum, 6061, was chosen as a material for the following reasons: (1) inexpensive, (2) easy to work, and (3) good weldability. The tank was assumed to be a pressure vessel with a maximum working pressure of 14.7 psi. The number of uses per mission was based on the size of Skylab disposal and trash bags. The trash bags are fabricated of a material which will retain water, but will also allow the bag to breath to allow pumpdown of the refuse to the vacuum pressure of the tank. Operation of the airlock was assumed to be 2 minutes per cycle.



APPLIANCE CONCEPT REQUIREMENTS AND PENALTIES CALCULATIONS

		FLECT	<u>LRICAL</u>	POWER	REQUIR	EMENTS		
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COMPONENT	(REF)	USE TIME CYCLE (HR)	PEAK (WATTS)	③ AVERAGE (WATTS)	DEMAID (WATT-HR/ CYCLE) (DX(3)	(S) PEAK (WATTS)	6) AVERAGE (WATTS)	DE11/ (WATT- CYCLE (1) X
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			LATENT		SIBLE	HEAT LEAK		COOLANT
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		TOTAL	WATT (BTU/HR)	WATT	(BTU/HR)	WATT (BTU/HR)	MAT'	T (BTU/H
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N	<u> </u>		<del></del>			·	<del></del>	
						<del></del>	<del></del>	

TOTAL WATTS/CYCLE · WATTS/CYCLE (BTU/HR/CYCLE) (LB/MISSION) M<sup>1</sup>/MISSION (FT<sup>1</sup>/MISSION) 45

APPLIANCE CONCEPT REQUIREMENTS AND PENALTIES CALCULATIONS (CONCLUDED) INDEX NUMBER 3.2.5.1 CONCEPT 1/ VACUUM STORAGE EIXED WEIGHI/YOLUME WEIGHT COMPONENT (LBS) (REF) 239 TANK (GOLI ALUM) STORAGE 80.1 (587)TOTAL 16:6 M3 (FT3) KG (LBS) W T/Y O L REQUIREMENTS SOLID VOL/UNIT (REF)
(PKG.VOL/UNIT)(REF)
(FT3) WT/UNIT (REF)
(PKG.WT/UNIT)(REF) UNITS/CYCLE(REF) TYPE (LB)  $\Sigma$ 3  $\Sigma$   ${}_{\odot}$ TOTAL VOL/CYCLE (FT 3) TOTAL WT/CYCLE (LB) TOTAL WT. TOT.WT/CYCLE (LB) DAYS/MISSION KG (LB) CYCLES/DAY ١ TOTAL VOL CYCLES/DAY DAYS/MISSION M3 (433) . 6 A S/L 1 Q U 1 D REQUIREMENTS EXPENDABLES 0 AMT.RECOVERED/CYCLE

0 x 0
(LB) AMT LOST/CYCLE 0 RECOVERY AMT.USED/CYCLE(REF)
(LB) FACTOR TYPE  $\Sigma \odot .321$ .321 Σ0 \_ /22.8 · N/A

SPACECRAFT Space St	ation				
HABITABILITY SUBSYSTEM	Housekeeping	HABITADILITY	FUNCTION	Refuse M	lanagement
APPLIANCE FUNCTION Re	fuse Di <b>s</b> posal	• •		<del></del>	
APPLIANCE CONCEPT NO./	TITLE 2/Storage	Bin/Container		<del></del>	
INDEX NO. 3.2.5.2		REF. NO1	70		

DESCRIPTION: The storage bin/container concept employs a locker to store the refuse. Sterilant capsules were assumed for retarding the bacterial growth. The refuse was assumed to be collected by bags (Skylab, or equivalent, and transferred to the storage locker. A concept provides a sterilant capsule for each bag of refuse stored in the locker. The capsules used for the study were 2.25 grams each with a volume of .33 cubic inches. The walls of the storage locker were assumed to be aluminum. Sizing of the locker was based on the refuse volume including the storage bags.

CONCEPT 2/5TORMGE BIN/CONTINUER

1/3

INDEX NUMBER 3.2.5.2

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N/4						
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	9	PERAII		ENALILES		
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N/A	<del></del>				<u></u>	

C2-490

WATTS/CYCLE (BTU/HR/LYCLE) KG/MISSION)

M³/MISSION (FT¹/MISSION)

TOTAL

WATTS/CYCLE (BTU/IR/CYCLE) APPLIANCE CONCEPT REQUIREMENTS AND PENALTIES CALCULATIONS (CONCLUDED)

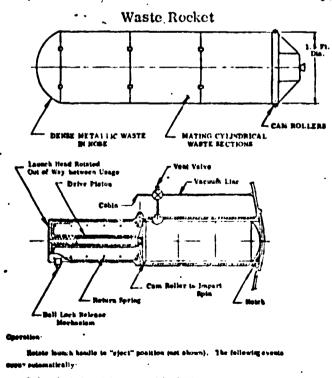
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CONCEPT 2/STORAGE BIN/CONIMINOR INDEX NUMBER 3, 2, 5, 2 WEIGHT/VOLUME REQUIREMENTS WEIGHT (LBS) VOLUME (FT3) COMPONENT (REF) 95. STORAGE BIN (GOGI ALUM) STURILANT CAPSULOS TOTAL KG (LBS) M3 (FT3) SOLID EXPENDABLE H T/Y O L WT/UNIT (REF)
(PKG.WT/UNIT)(REF)
(LB) UNITS/CYCLE(REF) STERILARIT 00496 CAPSULES 00496 .000191 YOTAL WT/CYCLE (LB) TOTAL NT. TOTAL VOL · GAS/LIQUID EXPENDABLES REQUIREMENTS

TYPE N/A	ANT.USED/CYCLE(REF)	RECOVERY FACTOR	AMT . RECOVERED/CYCLE  O X Ø  (LB)	ANT LOST/CYCLE
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SPACECRAFT Space Station	
HABITABILITY SUBSYSTEM House	sekeeping HABITABILITY FUNCTION Refuse Management
APPLIANCE FUNCTION Refuse	Processing
APPLIANCE CONCEPT NO./TITLE	3/Solid Propellant Refuse Rocket
'INDEX NO. 3.2.5.3	REF. NO. 202

DESCRIPTION: The solid propellant refuse rocket concept utilizes a rocket to jettison refuse to earth for aerodynamic incineration. The study assumes the refuse is jettisoned from a 300 nautical mile orbit using an incremental **velocity** ( $\Delta V$ ) of 434 feet/second to alter the rockets velocity to cause it co reenter the earth atmosphere. Atmosphere drag at the 300,000 foot re-entry altitude chosen for the calculations (reference 202) is of such magnitude as to cause the trajectory to degenerate rapidly. The equation for a minimum energy Hohmann transfer ellipse were used for determining the required velocity increment for reentry. A solid rocket was chosen because a solid rocket is easy to use and transport, and may be fired with simple electrical circuits. The ability of, solid propellants to withstand long storage periods at extremes in temperature and pressure without attention is also a benefit for this type of application. The solid rocket in this application is superior to a liquid rocket in total impulse to total weight ratio primarily because of the greater energy per unit volume. Therefore, less dead weight structure is required to carry the propellant. The size of the rocket was based on the total refuse volume compressed by a compactor to minimize the rocket volume. The concept was penalized for a compactor with a compression ratio of 0.2. (Air Pressure Type).



CONCEPT 3/SOLID PROPERLANT KEFUSE ROCKET INDEX NORMER 3.2.5.3

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N/A		*****	<del></del>			and cold frequency as a constant
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APPLIANCE CONCEPT REQUISIONS AND PERMETTES CALCULATIONS (CONCERN)

CONCEPT 3/SOLIO PROPELLANT RUFUSU RUCKET INDEX NUMBER 3, 2, 5, 3

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TOTAL WT.				

HABITABILITY SUBSYSTEM_	3.0	Housekeeping
HABITABILITY FUNCTION	3.3	Garment/Linen Maintenance
APPLIANCE FUNCTION	3.3.1	Garment/Linen Washing
NUMBER OF CONCEPTS CONS	DERED_	10

#### **ASSUMPTIONS**

A number of references were found which present data for various clothes washer and dryer concepts (Reference 70, 90, 91, 100, 127, 161, 1.1, 185, 202, 237 and 245). These references were reviewed in detail, and the engineering data from each examined. It was soon found that much of the data did not agree. The primary reason for discrepancies was that the data were mostly very sketchy, without detailed breakdowns to define the data. For example, the clothes washer weight in one reference would include the agitator tub only, while another would include peripheral equipment such as water accumulators, processing equipment or other miscellaneous items. One reference was found (#90) which contained all the concepts found throughout the other reports and presented the data for each in a consistent manner for direct comparison. Therefore, it was decided to collect all the clothes washer and dryer data for this study from Reference 90.

A ground rule of 2-clothes washings per day was assumed from Reference 273. For this condition, and assuming a 6-man space station crew, a detailed study of Space Station clothing usage (Reference 245) has shown a maximum laundry load of 1.66 kg (3.68 lbs). Since the clothes washer load assumed in Reference 90 is only slightly larger than this, or 1.81 kg (4.0 lbs), the data from that reference were used directly without adjusting

The water usage for the automatic concept was assumed 24.9 kg (55 lbs) for washing and 24.9 kg (55 lbs) for rinse as recommended in Reference 273. Rinse water was assumed to be temporarily stored to be reused as wash water. Wash/rinse time was taken to be one hour.

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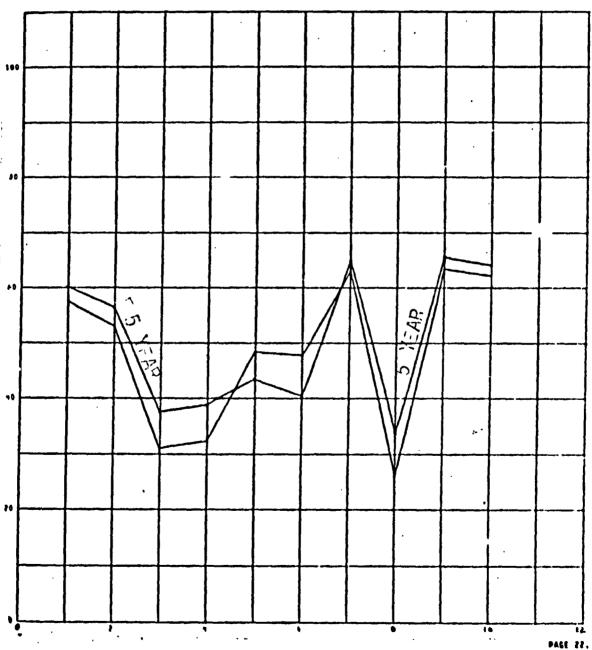
APPLIANCE CONCEPT FUNCTION MATRIX

GARNENT/LINEN WASHING ISPACE STATION:

	CONCETT  CONCETT  CONCETT  NO.  FULDIC AGITATION  FULDIC AGITATION  CTCLIC VALVE AND PUMP AGITATION  CTCLIC VALVE AND PUMP AGITATION  A DIAPHRAM ACTUATED-THO DIRECTIONAL SOUEEZE  DIAPHRAM ACTUATED-THO DIRECTIONAL SOUEEZE  A DIAPHRAM ACTUATED-THO DIRECTIONAL SOUEEZE  A DIAPHRAM ACTUATED-THO DIRECTIONAL SOUEEZE  A DIAPHRAM ACTUATED-THO DIRECTIONAL SOUEEZE  A DIAPHRAM ACTUATED-THO DIRECTIONAL SOUEEZE  A DIAPHRAM ACTUATED  O DIAP	(*)  2 - CABIN AIR (CIRCULATE 2 - CABIN AIR (LOST) 3 - OXYGEN 4 - COOLING WATER (LOST) 5 - WATER (LOST) 6 - NITROGEN (CIRCULATE 7 - NITROGEN (USED) 8 - FREGN (USED) 9 - WATER (PROCESSEE (1) AVAILABLE (2) STATE OF THE ART (3) SOME DEVELOPMENT REQUIRED (4) EXTENSIVE DEV. REQUIRED	(CIRCULATED), LITERS/SEC (FT <sup>3</sup> /MIN) (LOST)	2
	ORIGINAL PAGE OF POOR QUAL			
73333				:

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APPIIANCE
CONCEPT
NO. CONCEPT NAME

1 - HECHANICAL OSCILLATION
2 - FLUIDIC AGITATION
3 - PISTON AGITATION
4 - CYCLIC VALVE AND PUMP AGITATION
5 - DIAPHRAM ACTUATED-ONE DIRECTIONAL SQUEEZE
6 - DIAPHRAM ACTUATED-TWO DIRECTIONAL SQUEEZE
7 - WATER SPRAY AGITATED
8 - ULTRASONIC
9 - HANUAL MASHBOARD
10 - PLAIN RECIRCULATION
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CONCEPT NUMBER

Garment/Linen Washing (Space Station) Concept Trade

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SENSITIVITY ANALYSIS

APPLIANCE CONCEPT COMPONENT SUMMARY MATRIX

3.3.1-GARMENT/LINEN/WASHING

APPLIANCE FUNCTION:

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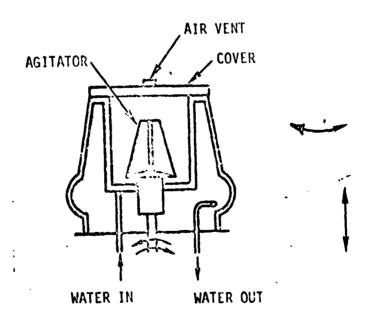
SAFETY CRITICAL NUMBER ITEMS R ELECTROACOUSTIC CONTROLLER CONTROLLER СОИТВОГСЕВ VALVE (PNEUMATIC) z SECULATOR SPRESSURE w z 0 ELECTRICH SWITCH ۵ Σ 0 ILTER. SMITCH FLUIDIC ဖွ 0 RANSMISSION SEPARATOR SEPARATOR œ ш ACCUMULATOR BLADDER 8 Σ ⊃ ACCUMULATOR 2 0 NALVE SOLENOID dWNc **MOTOR** COMPONENT TYPE 21) DIAPHRAGM ACTIVATED-ONE DIRECTIONAL SQUEEZE (pg. 31) DIAPHRAGM ACTIVATED-TWO DIRECTIONAL SQUEEZE (pg. 24) CYCLIC VALVE AND PUMP (pg. 29) WATER SPRAY AGITATED (pg. 36) PLAIN RECIRCULATION (pg. 45) MECHANICAL OSCILLATION (pg. FLUIDIC AGITATION (pg. 24) ULTRASONIC WASHER (pg. 38) MANUAL WASHBOARD (pg. 41) PISTON AGITATION (pg. 27) NONDISPOSABLE CLOTHES APPLIANCE TYPE

# D2-118561-5

SPACECRAFT Space Station		
HABITABILITY SUBSYSTEM House	keeping HABITABILITY FUNCTION	Garment/Linen Maintenance
APPLIANCE FUNCTION Garmen	t/Linen Washing	
APPLIANCE CONCEPT NO./TITLE	1/Mechanical Oscillation	
INDEX NO3.3.1.1	REF. NO90	
		,

## **DESCRIPTION**

This concept is similar to a conventional washer. A central agitator provides the washing either by rotational or translational oscillation. A high-speed rotation extracts wash and rinse water and is used to spin dry the clothes before final drying.

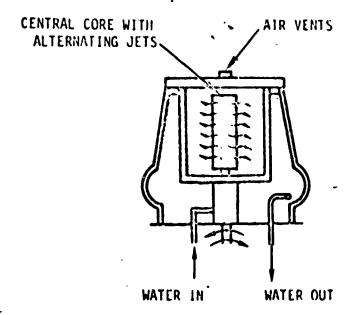


CONCEPT M. 1		:sillation	NCL CONCEPT REQUI			INDEX	NIMBER 3.	<u> </u>
(Ref.	#92 p.1.	,/?) 	<u>LRICAL P</u>	OMER	<u>REQUIR</u>	EMENIS		
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			IHERMAL.	<u>R E Q U ` !</u>	REMENTS			
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later la	A loca	(40°F)	<u>. ()</u>	_ <i>44</i>	02	4400	-	0
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		TOTAL			· (4 gm)	1459 (47)	,	0
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		MEAT	THERMAL "	CON AUT	ELECTRICAL	. WEIGHT		ÒLUME
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N/	A				·			
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		MATT	S/CYCLI WAT	115/CYCLE		KP/H1221	(N N3/	H15510N

	F1XED	MEIGHT/	<u>VOLUME RE</u>	QUIREMI	ENTS	
COMPONENT  Bacic Carlor	(REF)	•	WEIGHT (LBS) Z')			YOLUME (FT3)
Accusiled 1		<del></del>	40			
Principal party			4			
Valence des			<u> </u>			
York . 1.3		<del></del>	(7			
Michigan Const						7.9
	TUTAL		90.7 (c)	2)	0.4	93 (17.4) Nº (FT <sup>3</sup> ).
•			•			
	. <u>1 D                                  </u>	ENDABL  WT/UNIT (F (PKG.WT/UNIT (LB)	(SEL) ALLYCA	CLF V(	EMENTS  OLJUNIT (REF) S. VOLJUNIT) (REF	(F13)
Petrag de /	1	T.07.55		ند.		0019
Germicide				<del></del>		
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	**					
	•		\(\sum_{\text{id}}\) \(\frac{1}{2}\) \(\frac{1}\) \(\frac{1}{2	/nat	Σ 3	TOTAL VOLVEYCEE
MISSION CYCLES/DAY	X DA	141/ VS/MISSTON	101.ht/crc (LB)	·	11.	Ke (in)
NISSION CYCLES/DAY	XDA	124 VS/HISSION	_ x0019 TOT.VOL/CF (FT3)		0.0	) (0.77) W (177)
6 A	<u> </u>	EXPE	N P. A B L E S	REQUIRE	MENTS	•
		<b>D</b>	. ②		O PINID/CACTE	AMT LOST/CYCLE
	AMT.USED/C	YCLE(NIF)	RECOVERY	AMT. RECOV	INIDICYCLE X(D) LB)	AMT LOST/CYCLE (LB)
TYPE Washings for	, (u 5:		FACTOR 999.1		18)	(LB) 04°''
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SPACECRAFT_	Space Sta	tion	antremo 4		Caumant /l inan
HABITABILI1	TY SUBSYSTEM	Housekeeping	HABITABILITY	FUNCTION_	Garment/Linen Maintenance
APPLIANCE F	UNCTION	Garment/Linen	Washing		
APPLIANCE (	CONCEPT NO./1	TITLE 2/F1	uidic Agitation		
INDEX NO	3.3.1.2		REF. NO	90	
_					

In this concept, water is sprayed through a central column of stacked fluidic switches which direct water in alternating directions through jets. A high-speed rotation extracts wash and rinse water, and is used to spin-dry the clothes before final drying.



CONCERT FILLS A 4	<u>Letern</u>	NCE CONCEPT REQUI	REMENTS AND	PENALTIES CAL	CULATIONS INDEX	NUMBER 7	.1.
(hil. # 90 , 20		IRICAL P	ONER	REQUIR	T M F N T S		
		AC			DC	POWF	!
COMPONENT (REF)  Volume  Prince  Prince  Volum	USE TIME CYCLE (HR)	PEAK (HATTS)	AVERAGE (WATTS)  O	DETIVED (WATT-HR/ CYCLE) () X(3)	DEAK (WATTS)	6 AVERAGE (WATTS)	DEFIANTE (WATT-HE CYCLE)
Anikon arta		150					
		277 MAXIMIM	•	TOTAL	O MAXIMUM	•	TOTAL
				•			
, SOURCE		THERMAL.  LATENT (BTU/HR)	SEN	<u>remenis</u> Sible U/Hr)	HEAT LEAK (BTU/HR)		OOLANT U/HR)
Wite heat to 14.	, "r")	· ·	14.15	17,1	4400		0
1'. 11.	<del></del>	0		() <del>(</del> '	101		0
lgidad r. p. dir			5	1")			()
	TOTAL	MATT (BTU/HR)	147	(DTU/HR)	1477 (-/	)	C (BTU/HR)
ORIGINAL PAGE E OF POOR QUALITY		•					
	9	PPERATION	AL LE	MALILE	<u> </u>		
SOURCE	HEAT	THERMAL TO (BTU)	COOLANT HR/CYCLE)	ELECTRICAL (PK WATTS/C		_	LUME H155104)
N/A					•		
			,				
70	MATT (BTU/	S/CYCLE NAT	15/CYCLE /HR/CYCLE)	• • • • • • • • • • • • • • • • • • • •	KG/M15510 (LB/M15510	- N N <sup>1</sup> /M N) (F1 Y	1:510N MISSION)

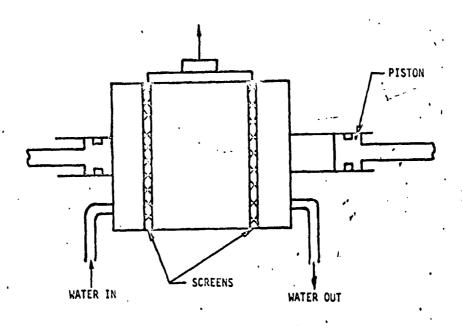
C2-508

APPLIANCE CONCE	PT REQUIREMENTS AND PENALTIES CALCULA	TIONS (CONCLUDED)  INDEX NUMBER	
(Kef. #90 pi4, 20)			
·	METCHI/NOFAWE BECAT	REMENIS	
COMPONENT (REF)	WEIGHT (LBS) 79	VOL (FT	UME
Parp			<u></u>
2 a contators	40		3.6
Adder sept for	7		
P. de la la la la la la la la la la la la la			4.8
Miscell prais		***************************************	7. 5
· · · · · · · · · · · · · · · · · · ·			
TOTAL	87.5 (1?3) KG (LBS)	0.52 M3 (	
		•	•
<u>SOLID</u> EXP		QUIREMENIS	, (S)
TYPE UNITS/CYCLE(REF)	#T/UNIT (REF) #T/CYCLE (PKG. WT/UNIT) (REF) (LB) (LB) (LB)	VOL/UNIT (REF) (PKG.VOL/UNIT)(REF) (FT3) . 0016	VOL/ÇYCLE ① x ④ (FT³) .0019
Germicide	1.060	(.0019)	10011
	,		
•	TOTAL WT/CYCLE (LB)	Σ ③ . <sub>10</sub>	. / ( / / 9 TAL VOL/CYCLE (FT3)
TOTAL MT.  MISSTON  CYCLES/DAY  DA	15/1 YS/MISSION X YOF.WT/LYCLE (LB)	1/1.0 KG (	(24,3)
TOTAL VOL THISSION TO CYCLES/DAY X DA	x .0019 YS/MISSION x TOT. VOL/CYCLE (FT3)	0.020	(C.7)
<u>6 A S/L 1 Q U 1 D</u>	EXPENDABLES REQ	U L R E M E N I S	·
• • •		MT.RECOVERED/CYCLE AM	T LOST/CYCLE
AMT.USED/C	YCLE (REF) RECOVERY	MF.RECOVERED/CYCLE AM ① A ② (LB)	(LB)
Wash welce 50	FACTOR 9991	(LB)	04915
Rinse noter 50			0
		•	·
Σ①		Σ⊙	D#255
TOTAL WT.		-	7. 3
TOTAL WT.  MISSION  CYCLE/DAY  TAYS/MISS	STON X .0495 - 19.2.  101AL TOST/CYCLE (LB)	· 110 · 58	KG (LB)

SPACECRAFT	Space Station		_		
- HABITABILIT	Y SUBSYSTEM House	ekeeping	- HABITABILITY	FUNCTION	Garment/Linen Maintenance
APPLIANCE F	UNCTION Garment	/Linen Wash	ing		
APPLIANCE C	CONCEPT NO./TITLE_	3/Piston Ag	gitation		
INDEX NO	3.3.1.3		_REF. NO	90	

In this concept, two pistons are actuated alternately to pump water back and forth within the drum. Screens are added to increase turbulence and to contain the clothing within the drum.

Since there is no spin-dry capability, it was assumed, as recommended in Reference 90, that 1.36 kg (3.0 lbs) of water are left in the clothes over and above the water left by the other concepts after spin-dry. Therefore, a dryer penalty was assumed to handle this added water. For this purpose, the dryer concept 3.3.2.1 was assumed (forced hot air electric) since it had already been selected in the past (Reference 237) to build a prototype clothes dryer. Since the dryer penalties were based on removing 0.456 kg (1.0 lb) of water, and this washer concept has 1.36 kg (3.0 lb) extra water to be dried, all the penalties for dryer concept 3.3.2.1 were multiplied by 3 and added to the penalties for this clothes washer concept.



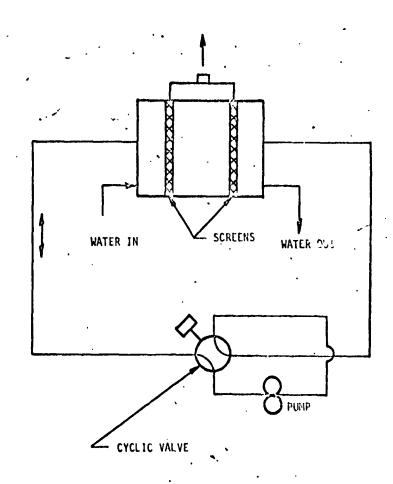
(Ref # 90 g)			-	÷	• •		INDEX NUMBE	R	<u></u>
(Ret 10 4. 2	EFECT	RICAL	<u> </u>	WER	<u>R E Q U 1 R</u>	EMENTS	<u>i</u>		
COMPONENT (REF)	USE TIME CYCLE (HR)	PEAK (WATTS	) (	POWE  AVERAGE (WATTS)	R  (4)  DEMAND (WATT-HR/ CYCLE) (1) X (3)	S PEAH (WATTS	AVE	POWER  RAGE  TTS)	DEMANE (WATT-HR CYCLE) (DX)
17.0		3,7			•				
	***************************************		-	•	TOTAL	O MAXIMU	м ,	•	TOTAL
•					· ·			<u>.</u> .	•
• SOURCE		THERM  LATENT  (BTU/HR		SEN	<u>rements</u> Sible U/HR)	HEAT			OOLANT
Water heat loss (:	·;·)	ņ	•.	41	100	<u>4</u> 11	00		Ö
Remp		<u>()</u>			19	1	09		0
Mintor							<u> 19 -</u>		0
	TOTAL	O WATT (BTU)	WHR.)	/385 NATI	(4750) (BTU/HR)	1385 (B		LIATT	(0.711.410)
•		•	,		;	WALL (D	oynk)	WAII,	(BTU/HR)
	<u>0</u>	<u>P E R A T</u>	1 0 N A	L. Pe	NALTIE	<u> </u>	· •		
SOURCE	HEAT (BTU/HR/	THEI LEAK CYCLE)	MAL TO CO (BTU/HR	OLANT /CYCLE)	ELECTRICAL (PK WATTS/C		MEIGHT /MISSION)		LUME MISSION)
3 times dryer core	<u> </u>	099	_20	25.	216 A 681 z	·	2.40		2.8
allowede concept:		(108.7)		(2222)	24/		7 (240)		
. 10	TAL <u>319</u> WATTS (BTU/I	TOPETY R/CYCLE)	593 MARTS		216 A	· KG	<u>/ (24 c)</u> MISSION MISSION)	1.50 HYMI (FT)/I	(52.59 ISSION (18810V)

(Ref #10 +	, 27,2%)					
,		WEIGHT	/Y O L U M E	REQUIR	EMENIS	
	(255)	•	WEIGHT			VOLUME
COMPONENT  File washer	(REF)		(LBS)			(FT3) 10
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Valsie				<u>6</u>		
Valer - yourton				Ž <sub>I</sub> .		<del></del>
Packacies			6	O		,
Misseller Core						4.7
					<del>**</del>	
GIVAL PAGE FOOR QUALITY	<b>A</b>	. [		· · · · · · · · · · · · · · · · · · ·	<u> </u>	<b>7.</b>
GINAL QUALTE	TOTAL	, 'L	83.0	(402)		.52 (10.11)
BOOK .			• KG (LBS	)		M <sup>3</sup> (FT <sup>3</sup> ).
٠,	SOLID EXP	<u>PENDABI</u>	LE WIVO	L REQU	<u>IREMENT</u>	<u>,</u>
		WT/UN1T	) (REF) W	③ ∏/CYCLE	Ø VOL/UNIT (REI	(S) F) <b>VOL/C</b> YCL <b>E</b>
TYPE	① UNITS/CYCLE(REF)	(PKG.WT/UNI	IT)(REF) (	①X② (LB)	(PKG.VOL/UNIT)	(ŘEF) ①X ④ (FT³)
Determent/		.054	7	066	.0016	0019
Germicide		1.065	<u> </u>		(.0019	
•					*****	
		<del></del>				<del></del>
			<del></del>			
•	•		Σ3i	UE (. L WIZLYCLE	. Σ	TOTAL VOL/CYCLE
OTAL WT				(LB)		. (FT <sup>3</sup> )
Michigan	2 X X DA	J K, IJ VYS/MISSION	x <i>.00</i>	164CLE .	'	1.0 (24.3)
`			(L	В)		(25)
OTAL VOL	XX	1511.	x <u>.00</u> 1	9	0.	020 (0.7
Citt	S/DAY DA	MSZM12210N	101. <b>4</b> 0	i/cyclt T³)		M3 (FT3)
		•		•		
	<u>G A S/L 1 Q U 1 D</u>	EXPE	ENDABLES	REQUI	REMENTS	
			. ②	AVT	(3) RECOVERED/CYCLE	AMT LOST/CYCLE
• •	(	D				MIL COSTYCICLE
TYPE	AMT.USED/C	TYCLE (REF)	RECOVERY	Arii .	0,0	တူ့အ
TYPE		YCLE (REF)			Ox (C)	0:0 (10) 
	AMT.USED/C	CYCLE (REF)  .B)	RECOVERY FACTOR		①x② (LB)	0-3 (ii) 
Nach water	AMT.USED/C	CYCLE (REF)  .B)	RECOVERY FACTOR		① x ② (LB)	.0495
Nach water	AMT.USED/C	CYCLE (REF)  .B)	RECOVERY FACTOR		①x②′′(LB)	.0495
North water Ringe water	AMT. USED/C , (L 	CYCLE (REF)  .B)	RECOVERY FACTOR		(LB)	.0495
North water Ringe water	AMT.USED/C	CYCLE (REF)  .B)	RECOVERY FACTOR		①x②′′(LB)′′	.0495

SPACECRAFT Space Station	Garment/Linen
HABITABILITY SUBSYSTEM Housekeeping HABITABILITY	
APPLIANCE FUNCTION Garment/Linen Washing	
APPLIANCE CONCEPT NO./TITLE 4/Cyclic Valve and Pump	
INDEX NO. 3.3.1.4 REF. NO. 9	90

This concept is identical in operation to #4 (Piston Agitation), except that the water pumping is accomplished by a pump and cyclic valve rather than opposing pistons. Screens are included to contain the clothing within the drum as well as to increase turbulence.

No spin-dry capability was assumed, just as in concept #4, and again 1.36 kg  $(3.0\ lb)$  additional water was assumed to require drying. This was handled in the same manner as was explained in concept #4; thus, all the penalties for dryer concept #3.3.2.1 were multiplied by 3 and added to the penalties for this clothes washer concept.



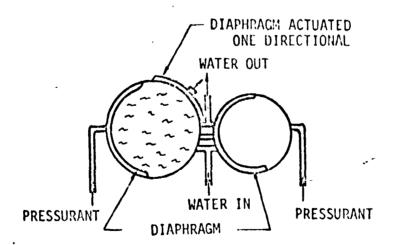
APPLIANCE CONCEPT REQUIPEMENTS AND PENALTIES CALCULATIONS

(Re( # 90 7 2 9,	Se) ELECI	PICAI	<u> </u>	<u>P E Q U I</u>	D F M F		IUMBER	<del></del>
	FFFFT	VITOF		NER .	VEGE	D C	POWE	: <b>R</b>
COMPONENT (REF) Valsing	USE TIME CYCLE (HR)	PEAK (WATTS)  55	AVERAGE (WATTS)	DEMAN (WATT-H CYCLE)	D (1	S PEAK HATTS)	6 AVERAGE (WATTS)	(7) DEMAN (WATT-H CYCLE) ① X (7
				TOTAL	——————————————————————————————————————	O AXIMUM	•	TOTAL
·		<u>[                                    </u>	<u>.</u> <u>R</u> EQU	<u> </u>	<u>ı ş</u>		•	
Source		LATENT (BTU/HR)		SENSIBLE (BTU/HR)		HEAT LEAK (BTU/HR)		COOLANT
Water hard to UL	Vot. )		• '	44.00		4455		. O
Tung				<u> </u>		218		0
1	TOTAL	0	  · 13	53 <b>(</b> 4(2))	13:	72 16 193		<u> </u>
		WATT (BTU/H	IR) WA	TT (BTU/HR)	MA.	TT (BTU/HR)	NAT	T (BTU/HR)
•	•						-	• ·
• • • •	. <u>o</u>	PERAL	Lonal	<u>PENALTI</u>	<u>E S</u>			٠.
SOURCE	HEAT (BTU/HR/	THERM LEAK CYCLE)	TO COOLANT (BTU/HR/CYCLE	ELECTR ) (PK WATT		WEIGHT (LB/MISSIC		VOLUME (*/MISSION)
3 times dryen com	<u> </u>	1503	2025		6 40	2.41	<u>')</u>	5.7.9
extra dis 11.	12				7			
το	OTAL _3/9 WAT IS (BTU/)	(1007) GREYCLE IR/CYCLE)	592(20 WATTS/CYCLE (BTU/HR/CYCL		1.AC	109 (2 kg/missio (lb/missio		50 (55.5 MISSION MYPISSION)

	FIXED	<u>N E I G H</u>	I/X O F n	ME REC	<u>UIREME</u>	<u>N I S</u>	
COMPONENT	(REF)	•		WEIGHT (LBS)			VOLUME (FT3)
Torre	• • • • • • • • • • • • • • • • • • • •			770		•	10
<del></del>	-	-		4:			4.
<u>V.                                    </u>	1-	•		•			
11.							
<u>11</u>	·				****		4.9
		-				•	
		-	•				
		-					
	TOTAL	.[		37.1 (19	5)]	0.5	52 (1.1.
GINAL PAGE				KG (LBS)		\	M3 (FT3) .
POOR QUALIT	4					,	•
10020 0 ,	<u>SOLID</u> <u>EXP</u>	ENDA		3 1 <u>1/v 0 r</u>	REQUIRE	_	<u>(</u>
	Φ	WT/UNIT	JNIT)(REF)	WT/CYCL	E VOL	(4) ./UNIT (REF) .VOL/UNIT)(REF	VOL/CYCLE
TYPE	UNITS/CYCLE(REF)	.05	LB)	①x② (LB)	•	(FT <sup>3</sup> )	①x④ (FI¹) ,0014
Committee						0076	
Germands							
					<del></del>	<del></del>	
	•		Σ3	TOTAL WIZE		. ΣΘ	) - TOTAL VOLZEYCE (FT?)
		•		TOTAL WI/C	YCLI		101AL VOL/CYCI (FT3)
OTAL WT MISSION .	2 x	Jel.	x	.066		11.0	
CYCL	ES/DAY DA	ŸS/MĪSSION	·	TOT.WT/CYCLE (LB)		<del>L </del>	KG (LB)
OTAL VOL	· •	14.4	·	.0019		0.00	0 / 7
CYCL	ES/DAY X DA	YS/M13310	· · · ·	761. vol /cvcl (+13)	E	ت تربیب	й <sup>т</sup> (гт) <sup>—</sup> (
	•						
	<u> </u>				EQUIRE M		•
		_	PENDAB	. <b>0</b>			<b>(</b>
	AMT.USED/C	D YCLE(REE)	R	ECOVERY	AMT. RECOVE	RED/CYCLE	AMT LOST/CYCLI
TYPE LOUIS AS	(ι	B)		FACTOR	() ()	(B)	①·③ (LB)
March a 40		<u> 55                                  </u>		7991 1.000			0775
		·	<u> </u>				
-		·					
	Σ ①	<del></del> -	-	•		ΣΦ	. 11100
· ·			-				<del></del>

SPACECRAFT Space Station			Garment/Linen	
HABITABILITY SUBSYSTEM House	keeping HABITABILIT	FUNCTION		
APPLIANCE FUNCTION Garmen	t/Linen Washing			
APPLIANCE CONCEPT NO./TITLE	5/Diaphragm Actuated	- One Dire	ctional Squeeze	
INDEX NO 3.3.1.5	REF. NO	90		
DESCRIPTION				
	+,}			

This concept utilizes compressible diaphragms, operated by pressurized nitrogen, to alternately squeeze and soak the clothes. Wash and rinse water are removed at the end of each cycle by simultaneously pressurizing both diaphragms. This concept has been shown to be feasible, but its cleaning effectiveness remains to be proven by further testing.

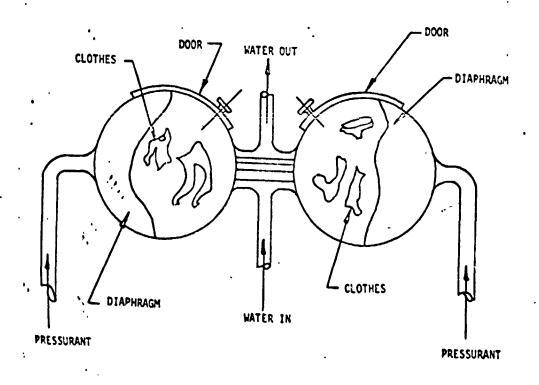


(Fif # 90 )	21-12)	CIRICAL		WER.	REQUIR!		C NUMBER	
•		· - · · · · · · · · · · · · · · · · · ·	A C	POWE		0	C POW	ΓĐ
COMPONENT (REF	USE TIM CYCLE (HR)	PEAK (WATTS		③ AVERAGE (WATTS)	DEMAND (WATT-HR/ CYCLE) (1) X (3)	⑤ PEAK (MATTS)	AVERAGE (WATTS)	DEMAND (WATT-HR CYCLE)
Kui								
			· M ·	•	TOTAL	O MAXIMUM	•	TOTAL
			•				•	
		<u> </u>			<u>REMENTS</u>			
SOURCE		LATENT (BTU/HR		(BT	SIBLE U/HR)	HEAT LEAK (BTU/HR)		O COOLANT (BTU/HR)
Pump	(113 )	<u> </u>	•	<u> </u>	45	<u>4400</u> <u>65</u>		<u> </u>
				***************************************				
	TOTAL	C WATT (BTU	/HR)	1309 WATT	(##)	1309 (#~	,	O
	,	•					•	
							-	•
		OPERAT		F 'EF	RALTIE:	2		
Source	H	EAT LEAK		OOLANT R/CYCLE)	ELECTRICA (PK WĄTIS/C			VÖLUME T <sup>3</sup> /MISSION)
<i>N/A</i>							•	
				· · ·				
	TOTAL W	ATTS/CYCLF TU/IR/CYCLF)		/CYCLE	to a second	KG/M155 (LB/M155	SION M	JANISSIOA JANISSIOA

•	FIXED	WEIGHI	YOLUME RE	QUIREME	N T S	
£0M00MFN7	/ncr\	•	WEIGHT	•		VOLUME
COMPONENT	(REF)		(LBS)			(FT3) 7, 7
324			.,			7,1
2 1 1						
<u> </u>	<del></del>	_			<del></del>	<del></del>
Contraction	<u> </u>		<del></del>			
No to the last	. 1 1,					
Co. P. San					,	
1:						
150000		_		<del>-,</del>		3.3
_	TOTAL	•[	4.7.2 (15)	- 7 7	0.4	f2 (::
TAL PAGE IS	}	. L	KG (LBS)			M <sup>3</sup> (FT <sup>3</sup> ) .
INAL QUALITY	Si	٠				
INAL PAGE IS POOR QUALITY	SOLID EXE	ENDAB		REQUIRE		,
	Φ .	MT/UNIT MT/UNIT (PKG.WT/UN	) (REF) <b>₩</b> ፗ/ <b>C</b> YC	LE VOL,	(NEF) VOL/UNIT)(REF	<b>40ľ/C</b> 4CI
TYPE	UNITS/CYCLE(REF)	(PKG.WT/UN (LB	IT)(REF) ①X(2	) (PKG.	VOL/UNIT)(REF (FT³)	) ①x (4) (FT <sup>3</sup> )
De formal		050			(10	.0012
Germicida		-(46-64-	<del>/</del>	کمان ساخت	<del>(1''.)</del>	
•						
	· ————————————————————————————————————			<del></del>	<del></del>	
			Σ③		ΣΘ	.(019
		•	TOTAL WT/	CYCLE		(17.7.2) 101AL VO170 (17.1)
TOTAL WT.	<b>-</b>	19#	x 066	=	<u></u>	0 (5)
WISSION CAC	LLES/DAY X DA	TYS/HISSION	iot.it/cycl			KG (LL)
TOTAL VOL			(LB)			
MISSION TOTAL VOL	CLES/UAY X DA	1011	_ x0019 TOT.VOL/CYC	• 	0.0	HT (F17) (
Cit	LES/DAT UP	(VS/M15STON	(FT3)	. t		He (F)-)
			•		•	•
	6 A S/L 1 Q U 1 D	EXP	ENDABLES R	EQUIREM	ENTS	
•			. ②	(	<b>D</b>	•
	AMT.USED/C	① :YCLE(REF)	RECOVERY	AMT RECOVER	ETD/CYCLE	AMT LOST/CY
TYPE	, (L	.B)	FACTOR	(LI	eT .	(i)
Variation of		- /*	1,600	<del></del> -	<del></del>	
V	(,	_ <del>_</del>	<u> </u>		•	6.3
				- <del></del>		
	<b>5</b>			•		21
•	$\Sigma_0$	.3			$\Sigma \odot$ .	3407

TIMOT (NOTE 111 OCCUPANT)	keeping HABITABILITY FUN	CTION Maintenance
APPLIANCE FUNCTION Garment,	Linen Washing	
APPLIANCE CONCEPT NO./TITLE_	6/Diaphragm Actuated - Two	Directional Squeezc
INDEX NO. 3.3.1.6	REF. NO.	90

This concept is similar to concept #5 except that the clothes are stored in two tanks. Pressurized diaphragms are again used to alternately squeeze and soak the clothes. As in concept #5, cleaning effectiveness remains to be proven by further testing.

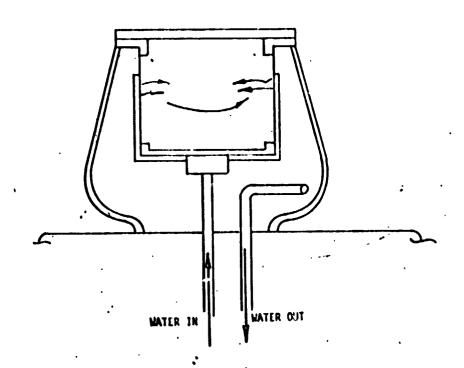


CONCER. The plan of	APPLIAN	ICE CONCEPT R	EQUIREMENTS AND	PENALTIES CAL	CULÄTIONS INDEX I	NUMBER 7, 1, 1, (.
(Red. #9: 1.34	, <sub>3′</sub> )					
·	FFFF	RICAL	POWER AC POWE	REQUIR!	D C F U F U T 5	POWER
COMPONENT (REF)	USE TIME CYCLE (HR)  1	PEAK (WATTS)  5.5	AVERAGE (WATTS)	DEMAND (WATT-HR/ CYCLE) (D) x (3)	(S) PEAK (WATTS)	( DEMAND AVERAGE CYCLI) (WATTS) (WATTS)
		75.			0	
		MAXIMUM	•	TOTAL	MAXIMUM	TOTAL
Scurie 1-1010-1-1-1-2-11	( <u>,,,,,</u> ;	LATENT (BTU/HR)	SEN (BT	REMENIS  SIBLE  U/HR)  402	HEAT LEAK (BTU/HR)  4/4/00	TO COOLANT (BTU/HR)  C
	TOTAL	MATT (BTU/H		7 (41) (BTU/HR)	1309 (ML) MATT (BTU/HR)	MATT (BTU/HF)
	9	<u>Perali</u>	•	MALIJE	<u>\$</u>	
SOURCE N/A	BLAT	THERM	TO CUCLANT (BTU/HR/CYCLE)	ELECTRICAL (PK WATTS/C		VÓLUME ON) (FT³/MISSION)
70	TAL					
	TTAM \UTH)	S/CYCLE)	MATTS/CYCLE (BTU/HR/CYCLE)		46/M1551 (LB/M1551	ON) (FT '/MISSION)

	FIXED	MEIGHI	<u>VOLUME RE</u>	QUIREME	N T S	
COMPONENT	(REF)	•	WEIGHT (LBS)			VOLUME (FT3)
Ten . Landier			<del>-</del>	·	· <del></del>	7.0
$2 - I_{con} - 1_{co}$		<del></del>	45			2,5
Halung					<del>;</del> -	
Contractor	10		$ \dot{z}$			
Territoria	110-		?			
Cully State			24	<del></del>		
Michael .						3.9
	Total	ا.		121	<u></u>	1
OLGE IB	Voinz		<del></del>	13.7		40 / H3 (H3).
NAL PROLITY			,			
NAL PAGE IS	FORID EXI	ENDABL		<u>require</u>	MENIS	Œ
	•	WT/UNIT (I (PKG.WT/UNI	<b>③</b> REF) <b>₩T/C</b> Y 1)(RLF) ①X(	CLE YOU 2) (PKG.	/UNIT (REF) VOL/UNIT)(REF)	(5) VOL/CY (1) (1)
TYPE	UNITS/CYCLE(REF)	(LB)	(LB	)	(FT <sup>2</sup> )	
Deterior		Table 1		<u></u>		
Germicide						
	-		<del></del>			
		<del>, ,</del>		<del></del> -		
	•		Σ3 - C S	/ / <b>Ċ</b> ΥCTE <sup></sup>	Σ (3	TOTAL VOL
TOTAL WT.	7	102	x 066		11.0	
CYC	CLES/DAY OF	IVS/MISSION	TOT.WITCH	<del></del>		KG (Lb)
TOTAL VOL .	<b>a</b>	1<4		•	6.00	
CAC CAC		WOLSTIW/SA	X	ate -	0,02	(111) (N
	•		(11-7)			
	<u>6 A S/L 1 Q U 1 C</u>	EXPE	NDABLES	REQUIREM	ENTS	•
• • •		0	<b>②</b>	AMT . RECOVE	Ð	AMT LOST/
TYPE	AMT.USED/O	YCLE (REF)	RECOVERY	APT , RECTIVE Q X (L	Q	(11) (1) - (3)
Mad . 1.		.0)	9971		• <i>)</i> 	0491
		۲ <u>۸</u>	1.11			<u> </u>
Water in	ــــــــــــــــــــــــــــــــــــــ	£.39 —	C	<del></del>		0.5
	Σ0 _11	7.75			$\Sigma \odot$ .	43

SPACECRAFT Space Sta	tion	<del></del>	Garment/Linen	
HABITABILITY SUBSYSTEM_	Housekeeping	HABITABILITY	FUNCTION_	Maintenance
APPLIANCE FUNCTION	Garment/Linen W	ashing		
APPLIANCE CONCEPT NO./T	ITLE 7/Water	Spray Agitation	)	
INDEX NO. 3.3.1.7		REF. NO	90	

In this concept, a high velocity jet of water is sprayed into a wire mesh drum from the outer circumference. The drum is slowly rotated to allow continuous removal of the water. A high speed spin cycle is used to remove the excess water after washing and rinsing.



APPLIANCE CONCEPT REQUIREMENTS AND PENALTIES CALCULATIONS (12) 4 of for)

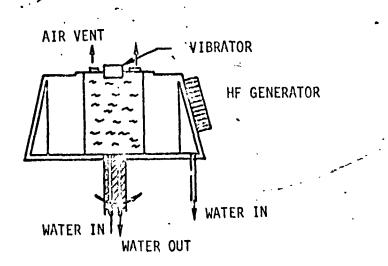
INDEX NUMBER 7. 7. 1. 7

		ω·	<u> </u>	POWE		D C	POWE	<u></u>
OMPONENT (REF	CY	* * * *	K S)	AVERAGE (WATTS)	DEMAND (WATT-HR/ EYCLE) ①x(3)	PEAK (WATTS)	AVERAGE (WATTS)	DEMAN (WATT-H CYCLE)
		MAXIM		•	TOTAL	<u>C</u>	•	TOTAL
			•		•		•	
		<u> </u>	AL,	<u>R E Q U 1</u>	<u>R E M E N I S</u>			
SOURCE		LATEN (BTU/H			ISIBLE TU/HR)	HEAT LEAK (BTU/HP)		COOLANT BTU/HP.)
pla lattes	/:; :: )		<del></del> .		<u> 400 -                                 </u>	4400		0
<u> 11. 1</u>		<u></u>			<u> 305</u> 512	<u> </u>		<u> </u>
	TOTAL	O WATT (BT	J/HR)	(14-7 WATT	<u>( ( ( ( ( ( ( ( ( ( ( ( ( ( ( ( ( ( ( </u>	1471 (505 WATY (BTU/HR)	-,	I (BIU/HR
						مسمور		
		<u>OPERA</u>	T 1 0 N	AL PE	NALTIES	<u>i</u>		
\$OURCE	•	HEAT LEAK .		COOLANT /HR/CYCLE)	ELECTRICAL (PK WATTS/CY			AQFAME 2 \WIRZION
N/A			,					
			,					
•	TOTAL	WATTS/CYCLE (BTU/HR/CYCLE)	MV	115/CYCLE B/HR/CYCLE)		KG/MISSI (LB/MISSI	ON M <sup>3</sup>	NOTSSIWA, NOTSSIWA

		<u>E 1</u>	X E D W E	I G H T/Y O L	<u>UME RE</u>	QUIREME	<u>N I S</u>	
(	COMPONENT		(REF)		WEIGHT (LBS)			VOLUME (FT <sup>3</sup> )
•	12. 1-10 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1.	<u> </u>	•		97)			10, =
•	Paris	40.			1			7.(
•	Nahu .	4.1	•		<del></del>		•	
	Partie				1:1			
	Miscolin							3.2
•				<del></del>	·			
•		<del></del>				·		<del></del>
			TOTAL	, 'L <u>,</u>	90.7 (: KG (LBS)		0.5	07 (* . N³ (FT³) .
TA TATE	PAGE IS				. Ka (FD3)		•	
POOP	QUALITY	<u> 5 0 L 1</u>		IDABLE (2)	M I\X 0 F	REQUIRE		, <b>©</b>
•			(PI	<b>∏</b> √T/UNIT (REF) KG.WT/UNIT)(RE	(3 ₩1/CY (LB (LB	CLE VOL ② (PKG.	(4) /UNIT (REF) VOL/UNIT)(REF)	\$\ \Q\ \(\frac{1}{2}\)\ \(\frac{1}{2}\)
	TYPE	/ UNITS/C	YCLE (REF)	(LB) .055	.06		(FT3) 0016	(FT3) 2019
•	Germicide	,		166)		(4)	<i>(12)</i>	
		<del></del>	<u></u>					
							<del></del>	
•			•	Σ	3 TOTAL WI		. Σ಄	TÓTÁL VÓL/CY
	TOTAL UT				. (LB	()	p. (	. (F1°)
•	TOTAL WT. =	CYCLES/DAY	X	AISSION X	101.WI/CYU	LE .	1 <u>1. C</u>	) (こり.:
	,	·		<i>t.</i>	(LB)		·	<del></del>
•	TOTAL VOL =	CYCLES/DAY	X	VISSION X	0019 101.VOL/CY (FT3)	CLE	6.020	η <del>ν (ετγ) (β. 7</del>
		•	,	•	(110)			
		<u> </u>	<u>Liguid</u>	EXPEND	ABLES	REQUIREM	ENTS	•
		_ <del>_</del>	• •		. ②	. AMT . RECOVE		AMT LOST/CYC
	TYPE		AMT. USED/CYCLE	E(REF)	RECOVERY FACTOR	AMI. RECOVE (L	(O) (B)	(LB)
	West when	••.	55		,7001		·	<u>, 0 /1 955</u>
•	Kinse 1. 1		<u>54</u>		<u>1,650</u>			
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		· · · · · · · · · · · · · · · · · · ·						
, ,					•		$\Sigma$ $\odot$	, 5495

SPACECRAFT Space S	tation			Garment/Linen
HABITABILITY SUBSYSTEM	Housekeeping	HABITABILITY	FUNCTION_	Maintenance
APPLIANCE FUNCTION	Garment/Linen Wa	ishing		
APPLIANCE CONCEPT NO./	TITLE 8/Ultras	onic		
INDEX NO. 3.3.1.8		REF. NO	90	

In this concept, ultrasonic energy is used to wash to clothes. A damping factor of 2 was assumed, which probably results in a gross underestimate of the actual electrical power required. The amount of water required was assumed to be the same as for the other washing concepts.

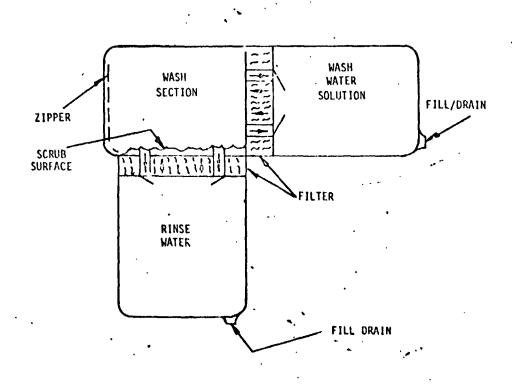


CONCEPT 17/15 150	APPL1AF	NCE CONCEPT RE	QUIRLHENTS AND	PENALTIES CAI	LCULATIONS INDEX	NUMBER 3.3.1.9
(Ref #92 p 3.	- 40) - 40)	<u>LRICAL</u>	POWER	RIQUIR	EMENIS	
			AC PONE	R .	D C	PONER
COMPONENT (REF)	USE TIME CYCLE (HR)	PEAK (WATTS)	3 AVERAGE (WATTS)	DEMAND (WATT-HR/ CYCLE) ①X(3)	⑤ PEAK (WATTS)	© DEMAND AVERAGE (WATT-IH) (WATTS) ① \(\frac{1}{2}\)
And it is a few to the Valva of		1200				
					0	•
		MAXIMUM	• •	TOTAL	MAXIMUM	TOTAL
		<u> </u>	<u> </u>	<u>R E M E N T S</u>	i	
, <b>SOU</b> RCE		LATENT (BTU/HR)		SIBLE U/HR)	HEAT LEAK (BTU/HR)	TO CUOLANT (BTU/HR)
Water best les (4	~ (F)	0	. 44	(20)	44/50	0
Purit	<del></del>	0	<del>-</del>	NO	10%	
11. 1.,		0		12	512	. 0
With the Land		<u>`</u>		// <u>0</u>	44/15	
	TOTAL	MATT (BTU/HR		2 <u>(9#15</u> ) (BTU/HR)	277,2(9//5) WATT (BTU/HR)	,
•		•			، معمد المستعدد المستعدد المستعدد المستعدد المستعدد المستعدد المستعدد المستعدد المستعدد المستعدد المستعدد المستعدد	
	9	PERATI	ONAL PE	NALTIE	<u>s</u>	
		THERMA	•			
SOURCE /	HEAT	LEAK	TO COOLANT BTU/HR/CYCLE)	ELECTRICA (PK WATTS/C		
N/A						
				•		
70	OTAL					
•	#A) T (B1U/	S/CYCLE HR/CYCLE)	WATTS/CYCLE (BTU/HR/CYCLE)	-	KG/MISSI (LB/MISS)	ON HEAMISSION (FIEAMISSION)

CONCEPT 11 14 1500	APPLIANCE CONCE	PT REQUIREMENT	S AND PENALTIES C	ALCULATIONS (CO	ONCLUDED) INDEX NUMB	ER 7.7.1.9
	<u>F1XED</u>	MEIGHIVY	<u>OLUME RE</u>	Q <u>U, 1 R E M E</u>	<u>N T S</u>	
COMPONENT  You is successful.	(REF)	•	WEIGHT (LBS) ⊊¹⊘			VOLUME (FT <sup>3</sup> )
Hay Commercy		<del></del>		<del></del>		
Value	:r:		71.5			7,
1. 1cr cy . a	(1)					•
Alve Income		•	7.			7 . *
,						
	TOTAL			(16)	0	55 (;;
		•	KG (LBS)			M³ (FT³).
Detergent/ Germicide	UNITS/CYCLE(REF)	WT/UNIT (RE (PKG.WT/UNIT) (LB)	<u>M 1/V 0 L</u> (REF)	CLE VOI 2) (PKG )	EMENTS  (A) L/UNIT (REF) (VOL/UNIT)(REF (FT3) (F	.0019
TOTAL WT	2 LES/DAY D	1 C 1/ AYS/MISSION .	x O 6.6. TOT.WT/CYC (LB)	•	11	
MISSION CYC	LES/DAY XD	1 C 4 Ays/Mission	x	CLE	0,0	M3 (173) (C.V)
	<u>G A S/L 1 Q U 1 I</u>	D EXPEN	DABLES	REQUIRE!	MENIS	•
TYPE  No A water  Binco to der	AMT.USED/(	Φ	RECOVERY FACTOR PORT		3 ERED/CYCLE	AMT LOST/CYCLE  ①-③ (LB)  (L4 7.7
`\	Σ ①	<u>'</u>			Σ@	11.75
TOTAL MT. CYCLE	70AY x — DAYS/KII	SSION X TOTAL	cyc- cost/cycle	<u> 15.5 + _</u> (LB)	110 ·	58.2 (129.2) KG (LB)

SPACECRAFT_	Space Stat	ion			Garment/Linen
HABITABILIT	Y SUBSYSTEM_H	ousekeeping	HABITABILITY	FUNCTION_	Maintenance
APPLIANCE F	UNCTIONGa	rment/Linen Wa	ashing		
APPLIANCE C	ONCEPT NO./TIT	LE 9/Manual	Washboard		
INDEX NO	3.3.1.9		REF. NO	90	

Due to the large amount of crew time required to manually wash clothes, this concept was not felt to be practical. However, it was included for comparison purposes with the automatic concepts. A zippered, Teflon bag is used to contain the clothes and water. The crewman manipulater the bag to achieve washing, and squeezes it to rinse and remove excess water. It was assumed that only 4.54 kg (10 lb) of wash and 4.54 kg (10 lb) of rinse water are required. It was estimated that 0.907 kg (2 lb) of water will be left in the clothes after final rinsing, over and above the amount left by the other concepts. This water is treated in the same manner as for concept #4; that is, the penalties for clothes dryer concept #1 were multiplied by 2 and added to the penalties for this clothes washing concept.

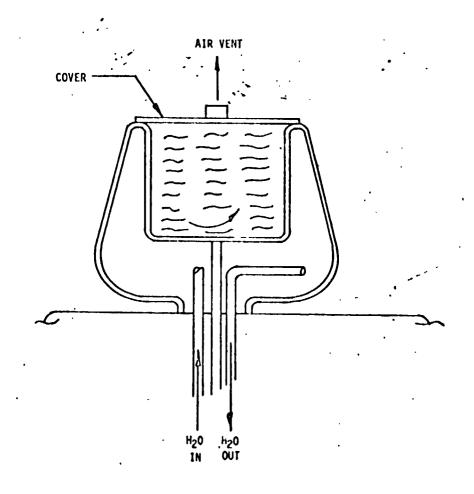


1	chlosi, d				INDEX NO	MHER 2.3.1.9
(Rel. #90, 4	1-43) ELECI	RICAL	POWER .	REQUIREM	<u>ENIS</u>	
					D C	POWER
COMPONENT (REF)	USE TIME CYCLE (HR)	② PEAK (WATTS)	(WATTS)	DEMAND (WATT-HR/ CYCLE) ① X ③	(3) PEAK (WATTS)	6 DEMAN AVERAGE (WATT-) (WATTS) ① X(
Yalves	0	p. 17	(	Ø@		(**************************************
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		7.5	•		0	•
		MAXIBUM .	•	TOTAL	MAX I MUM	TOTA
٠,		•	•		•	•
		•		•		•
			•		•	
	1	LHERMAL.	REQUI	REMENIS	•	•
• SOURCE		LATENT (BTU/HR)		SIBLE U/HR)	HEAT LEAK (BTU/HR)	TO COOLANT (BTU/HR)
Valor hoot loss (4)	0°5'F" \	. 0		gor.	800	. 0
Pung	<del></del> -	0	·	69	65	0
[ 14 C   1   1   1   1   1   1   1   1   1			·	<del></del>	,	
<del></del>			-		•	
<del></del>					<del></del>	
<del></del>		<del></del>		·····		<del></del>
•	TOTAL _	<u> </u>			54 (%)	
		WATT (BTU/HR)	WATT	(BTU/HR) W	ATT (BTU/HR)	WATT (BTU/HR
		•	•		•	•
•						
	•					• •
		•	•			
	. <u>ō</u>	PERATIO	NAL. PE	NALTIES	•	·
SOURCE	HEAT (BTU/HR/0	THERMAL LEAK T CYCLE) (BT	O COOLANT U/HR/CYCLE)	ELECTRICAL (PK WATTS/CYCLE)	WEIGHT (LB/MISSION	VOLUME (FT3/MISSION
•	.,+	726	1350	144 12	150	35.2
Himes Trues con	<del></del>	·.		454 7.0		
Almos Inger con	/ 45					
3, 3, 5, 1,	( <u>.</u> ;		<del></del>			
13.3.3.1 10.01 lry ? 1/4 of 11.11			•			
lry ? The of and extra above the						
13.3.3.1 10.01 lry 2 1/4 of 11.11						

100   100		FIXED	MEIGHT/Y	CLUME RE	QUIREME	<u>n i s</u>	
	COMPONENT	(055)	•	WEIGHT			VOLUME (ET3)
TYPE UNITS/CYCLE (REF)  ANTI-  AUSSION  CYCLES/GAY		• (		10	·	•	
TYPE  WILLIAM  WILLIAM  WILLIAM  SOLID EXPENDABLE MITTOUL REQUIREMENTS  WITOURI (REF)  WOLOWITI (REF)  WITOURI (REF)  WITOURI (REF)  WOLOWITI (REF)  WOLO	Irmit		<del></del>				
Type							0.11
THE UNITS/CYCLE (REF)  POOR WATER TOTAL  23.(	Validi					-	
TOTAL 23, (				4:5	***		and the second s
TYPE UNITS/CYCLE(REF)  OTAL WIT.  CYCLES/DAY X DAYS/MISSION X TOTAL WIT/CYCLE  MISSION  CYCLES/DAY X DAYS/MISSION X TOTAL WIT/CYCLE  MISSION  CYCLES/DAY X DAYS/MISSION X TOTAL WIT/CYCLE  CYCLES/DAY X DAYS/MISSION X TOTAL WIT/CYCLE  MISSION  CYCLES/DAY X DAYS/MISSION X TOTAL WIT/CYCLE  CYCLE	111111111111111111111111111111111111111					•	7.:
TYPE  SOLID EXPENDABLE MIVOL REQUIREMENTS  MIJORIT (REF)  MIJORIT							
TYPE UNITS/CYCLE(REF)  OTAL WIT.  CYCLES/DAY X DAYS/MISSION X TOTAL WIT/CYCLE  MISSION  CYCLES/DAY X DAYS/MISSION X TOTAL WIT/CYCLE  MISSION  CYCLES/DAY X DAYS/MISSION X TOTAL WIT/CYCLE  CYCLES/DAY X DAYS/MISSION X TOTAL WIT/CYCLE  MISSION  CYCLES/DAY X DAYS/MISSION X TOTAL WIT/CYCLE  CYCLE	TAGE 18				<del></del>		
TYPE  SOLID EXPENDABLE MIVOL REQUIREMENTS  MIJORIT (REF)  MIJORIT	GINAL PAGETTY	TOTAL	۰	23.6 (	(2)	0.20	14.
TYPE  SOLID EXPENDABLE MIVOL REQUIREMENTS  MIJORIT (REF)  MIJORIT	POOR QUAL				·		
TYPE UNITS/CYCLE (REF) (PKG. NT//WILT) (REF) (LB) (LB) (FRG. VOL/WILT) (REF) (LT) (LT) (LB) (LB) (REF) (RECOVERY (REF) (REF) (REF) (REF) (REF) (REF) (RECOVERY (REF) (REF) (REF) (REF) (REF) (REF) (REF) (REF) (REF) (REF) (REF) (REF) (RECOVERY (REF) (REF) (REF) (REF) (REF) (REF) (REF) (REF) (REF) (RECOVERY (REF) (REF) (REF) (REF) (REF) (REF) (REF) (REF) (REF) (RECOVERY (REF) (REF) (REF) (REF) (REF) (REF) (REF) (REF) (REF) (RECOVERY (REF) (REF) (REF) (REF) (REF) (REF) (RECOVERY (REF) (REF) (REF) (REF) (REF) (REF) (RECOVERY (REF) (REF) (REF) (REF) (RECOVERY (REF) (REF) (REF) (RECOVERY (REF) (REF) (REF) (REF) (REF) (RECOVERY (REF) (REF) (REF) (REF) (REF) (REF) (RECOVERY (REF) (RECOVERY (REF) (REF) (REF) (RECOVERY (REF) (REF) (REF) (RECOVERY (REF) (REF) (RECOVERY (REF) (REF) (REF) (RECOVERY (REF) (REF) (RECOVERY (REF) (REF) (REF) (REF) (REF) (REF) (REF) (REF) (REF) (RECOVERY (REF) (REF) (REF) (REF) (REF) (REF) (REF) (REF) (REF) (RECOVERY (REF) (RE	•						•
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District	/	UNITS/CYCLE(REF)	(LB)	(LB	7	(FT <sup>3</sup> )	(£13)
TIAL MT.  AISSION  CYCLES/DAY  DAYS/HISSION  CYCLES/DAY  DAYS/HISSION  CYCLES/DAY  DAYS/HISSION  CYCLES/DAY  DAYS/HISSION  CYCLES/DAY  DAYS/HISSION  CYCLES/DAY  DAYS/HISSION  DAYS/HISSION  TOT. VOICH CYCLE  MT (11')  CYCLES/DAY  DAYS/HISSION  DAYS/HISSION  TOT. VOICH CYCLE  MT (11')  CYCLES/DAY  DAYS/HISSION  DAYS/HISSION  TOT. VOICH CYCLE  MT (11')  ANT. RECOVERY  ANT. RECOVERY  FACTOR  (LB)  CYCLES/DAY  ANT. USED/CYCLE (REF)  FACTOR  (LB)  CYCLES/DAY  ANT. USED/CYCLE (REF)  FACTOR  (LB)  CYCLES/DAY  ANT. USED/CYCLE  ANT. USED/CYCLE  TYPE  ANT. USED/CYCLE (REF)  FACTOR  (LB)  CYCLES/DAY  ANT. RECOVERTO/CYCLE  ANT. RECOVERTO/CYCLE  ANT. RECOVERTO/CYCLE  ANT. RECOVERTO/CYCLE  ANT. OF CO. CYCLES/DAY  ANT. RECOVERTO/CYCLE  ANT. OF CO. CYCLES/DAY  ANT. RECOVERTO/CYCLE  ANT. OF CO. CYCLES/DAY  ANT. RECOVERTO/CYCLE  ANT. OF CO. CYCLES/DAY  ANT. RECOVERTO/CYCLE  ANT. OF CO. CYCLES/DAY  ANT. RECOVERTO/CYCLE  ANT. OF CO. CYCLES/DAY  ANT. RECOVERTO/CYCLE  ANT. OF CO. CYCLES/DAY  ANT. RECOVERTO/CYCLE  ANT. OF CO. CYCLES/DAY  ANT. RECOVERTO/CYCLE  ANT. OF CO. CYCLES/DAY  ANT. RECOVERTO/CYCLE  ANT. OF CO. CYCLES/DAY  ANT. RECOVERTO/CYCLE  ANT. OF CO. CYCLES/DAY  ANT. RECOVERTO/CYCLE  ANT. OF CO. CYCLES/DAY  ANT. RECOVERTO/CYCLE  ANT. OF CO. CYCLES/DAY  ANT. RECOVERTO/CYCLE  ANT. OF CO. CYCLES/DAY  ANT. RECOVERTO/CYCLE  ANT. OF CO. CYCLES/DAY  ANT. RECOVERTO/CYCLE  ANT. OF CO. CYCLES/DAY  ANT. RECOVERTO/CYCLE  ANT. OF CO. CYCLES/DAY  ANT. RECOVERTO/CYCLE  ANT. RECOVERTO/CYCLE  ANT. OF CO. CYCLES/DAY  ANT. RECOVERTO/CYCLE  ANT. OF CO. CYCLES/DAY  ANT. RECOVERTO/CYCLE  ANT. OF CO. CYCLES/DAY  ANT. RECOVERTO/CYCLE  ANT. OF CO. CYCLES/DAY  ANT. RECOVERTO/CYCLE  ANT. OF CO. CYCLES/DAY  ANT. OF CO. CYCLES/DAY  ANT. OF CO. CYCLES/DAY  ANT. OF CO. CYCLES/DAY  ANT. OF CO. CYCLES/DAY  ANT. OF CO. CYCLES/DAY  ANT. OF CO. CYCLES/DAY  ANT. OF CO. CYCLES/DAY  ANT. OF CO. CYCLES/DAY  ANT. OF CO. CYCLES/DAY  ANT. OF CO. CYCLES/DAY  ANT. OF CO. CYCLES/DAY  ANT. OF CO. CYCLES/DAY  ANT. OF CO. CYCLES/DAY  ANT. OF CO. CYCLES/DAY  ANT. OF CO. CY	~				<u> </u>		.0019
ANT LUSED/CYCLE (REF)  TYPE  ANT LUSED/CYCLE (REF)  ANT LUSED/CYCLE	· Hermuide .						
ANT LUSED/CYCLE (REF)  TOTAL WIT.  OTAL VOL.  CYCLES/DAY  ANT LUSED/CYCLE (REF)  TYPE  ANT LUSED/CYCLE (REF)  FACTOR  (LB)  ANT LUSED/CYCLE (REF)  FACTOR  (LB)  CYCLES/DAY  ANT LUSED/CYCLE (REF)  FACTOR  (LB)  ANT LUSED/CYCLE (REF)  FACTOR  (LB)  CYCLES/DAY  ANT LUSED/CYCLE (REF)  ANT LUSED/CYCLE (REF)  FACTOR  (LB)  CYCLES/DAY  ANT LUSED/CYCLE (REF)  ANT LUSED/CYCLE (REF)  ANT LUSED/CYCLE (REF)  ANT LUSED/CYCLE (REF)  ANT LUSED/CYCLE (REF)  CYCLES/DAY  ANT LUSED/CYCLE (REF)  A							
ANT LUSED/CYCLE (REF)  TOTAL WIT.  OTAL VOL.  CYCLES/DAY  ANT LUSED/CYCLE (REF)  TYPE  ANT LUSED/CYCLE (REF)  FACTOR  (LB)  ANT LUSED/CYCLE (REF)  FACTOR  (LB)  CYCLES/DAY  ANT LUSED/CYCLE (REF)  FACTOR  (LB)  ANT LUSED/CYCLE (REF)  FACTOR  (LB)  CYCLES/DAY  ANT LUSED/CYCLE (REF)  ANT LUSED/CYCLE (REF)  FACTOR  (LB)  CYCLES/DAY  ANT LUSED/CYCLE (REF)  ANT LUSED/CYCLE (REF)  ANT LUSED/CYCLE (REF)  ANT LUSED/CYCLE (REF)  ANT LUSED/CYCLE (REF)  CYCLES/DAY  ANT LUSED/CYCLE (REF)  A	· · · · · · · · · · · · · · · · · · ·						
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ANT LUSED/CYCLE (REF)  TYPE  ANT LUSED/CYCLE (REF)  ANT LUSED/CYCLE		<del></del>		<u>Sa 777</u>		<b>5</b> @	120,14
AMT. USED/CYCLE (REF)  TYPE  AMT. USED/CYCLE (REF)  TYPE  AMT. USED/CYCLE (REF)  AMT. USED/	•		•	TÓTAL WT.	/CYCLE	20	TOTĂL VÓL 7CYCLE
OTAL VOL  MISSION  CYCLES/DAY   X  1 C1/2  X  CYCLES/DAY  DAYS/MISSION  TOT.VOL7 YCLE  CYCLES/DAY  DAYS/MISSION  TOT.VOL7 YCLE  CYCLES/DAY  DAYS/MISSION  TOT.VOL7 YCLE  MY  (11')  CYCLES/DAY  DAYS/MISSION  TOT.VOL7 YCLE  MY  (11')  CYCLES/DAY  DAYS/MISSION  TOT.VOL7 YCLE  MY  (11')  CYCLES/DAY  DAYS/MISSION  TOT.VOL7 YCLE  MY  (11')  AMT.RECOVERY  DAYS  (LB)	DTAL WT.	٠	1 C //		•	71 /	
OTAL VOL.  MISSION  CYCLES/DAY  DAYS/MISSION  CYCLES/DAY  DAYS/MISSION  TOT.VOI/VICE  MY (17')  O.020  MY (17')  O.020  MY (17')  O.020  MY (17')  O.020  MY (17')  O.020  MY (17')  O.020  MY (17')  O.020  MY (17')  O.020  MY (17')  O.020  MY (17')  O.020  MY (17')  O.020  MY (17')  O.020  MY (17')  O.020  MY (17')  O.020  MY (17')  O.020  MY (17')  O.020  MY (17')  O.020  O.020  MY (17')  O.020  O.020  MY (17')  O.020  O.020  MY (17')  O.020  O.020  MY (17')  O.020  O.020  O.020  MY (17')  O.020  O.02	CYCLES	DAY DA		TOT .WIZCYCI	E	17.0	KG (LB)
CYCLES/DAY  DAYS/MISSION  TOT. VOIT CYCLE  MP (FT 1)  CYCLES/DAY  DAYS/MISSION  TOT. VOIT CYCLE  MP (FT 1)  CYCLES/DAY  DAYS/MISSION  TOT. VOIT CYCLE  MP (FT 1)  CYCLES/DAY  DAYS/MISSION  TOT. VOIT CYCLE  MP (FT 1)  AMT. RECOVERED/CYCLE  AMT LOST/CYCLE  TYPE  (LB)  FACTOR  (LB)  (LB)  (LB)  (C)  (C)  (C)  (C)  (C)  (C)  (C)  (	OTAL VOL		4 4.1 /				
GAS/LIQUID EXPENDABLES REQUIREMENTS   AMT.USED/CYCLE(REF) RECOVERY AMT.RECOVERED/CYCLE AMT LOST/CYCLE  (LB) FACTOR (LB) (LB)  (LB) (LB)  (LB)  (LB)  (LB)  (LB)  (LB)  (LB)  (LB)  (LB)  (LB)  (LB)  (LB)  (LB)	MISSION :-	Z/DAY DA	YSZMISSION	. X	rī F	0.02	<u> </u>
TYPE  ANT. USED/CYCLE (REF) (LB)  FACTOR (LB				(FT ')			
TYPE  AMT. USED/CYCLE (REF) (LB)  FACTOR (LB	,		•	•			•
TYPE (LB) FACTOR (LB) (LB) (LB) (LB) (LB) (LB) (LB) (LB)		E > 2/F 1 0 n 1 p	<u>EXPEN</u>	DABLES !	REQUIREM	ENTS	
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ΣΦ ΣΦ	·	. (			Û X	<b>P</b>	<b>()</b> -()
$\Sigma \odot$	TYPF	AMT. USED/C	YCLE(REF) ,	EACTOD .			
•	• • •	AMT.USED/C	B)				
•	Wach noter	AMT.USED/C	B) 	9201			01.1
•	Wach noter	AMT.USED/C	B) 	9201			101
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TAIL UT	Wash hater Rinso was	AMT. USED/C	B) 	9201			0

SPACECRAFT	Space Station				Garment/Linen
HABITABILITY	SUBSYSTEM Hous	ekeeping	_HABITABILITY	FUNCTION_	Maintenance
APPLIANCE FU	NCTIONGarment	/Linen Was	hing		
APPLIANCE CO	NCEPT NO./TITLE_	10/Plan	Recirculation		
INDEX NO	3.3.1.10		REF. NO	90	

In this concept, water is simply recirculated through the clothes washing tub, with no means to vigorously agitate the water. Cleaning effectiveness is, therefore, relatively poor, and its adequacy would have to be proven by further testing. A spin dry cycle is used to remove the excess water after washing and rinsing.



COMPONENT (REF) (HR) (MATTS) (	CONCEPT Plai	<u> 11 Ts 1</u>	APPLII	ANCE CONCEPT REQUIF	EMENTS AND	PENALTIES CAL	CULATIONS INDEX	NUMBER	1.1.1.
AC POWER  USE DIME  OF CONTROL OF COMMITTED  COMPOSITION (REF)  (	(1.+(.	# 72 F	. (j.le) Elec	IRICAL P	OWER	<u>REQUIR</u> 1	<u>LMENTS</u>		
USE TIPE  CVCIE PEAR AVERACE (MATT-NP)  CVCIE PEAR AVERACE (MATT-N				*				POWE	R
THERMAL REQUIREMENTS  LATENT SENSIBLE HEAT LEAK TO COOLANT BLEET MEIGHT VOLUME  TOTAL DIFFERENT SENSIBLE HEAT LEAK TO COOLANT BLEETICAL MEIGHT VOLUME  TOTAL DIFFERENT SENSIBLE HEAT LEAK TO COOLANT BLEETICAL MEIGHT VOLUME  TOTAL DIFFERENT TO COOLANT BLEETICAL MEIGHT VOLUME		(REF)	USE TIME CYCLE (HR)	PEAK (WATTS)	(3) AVE RAGE	(4) DEMAND (WATT-HP/ CYCLE)	(3) PEAK	<b>(</b> ) AVERAGE	UEMAN UEMAN (WATT-H CYCLE) ① X (/
THERMAL REQUIREMENTS  LATENT SENSIBLE HEAT LEAK TO COOLAN  SOURCE (BTU/HR) (BTU/HR) (BTU/HR) (BTU/HR)  TOTAL O 109 109 109 109 100 100 100 100 100 100									
THERMAL REQUIREMENTS  LATENT SENSIBLE HEAT LEAK TO COOLANT SOURCE (BTU/HR) (BTU/HR) (BTU/HR) (BTU/HR)  LATENT SENSIBLE HEAT LEAK TO COOLANT SENSIBLE HEAT LE				277			0	•	
SOURCE (BTU/HR) SENSIBLE HEAT LEAK TO COOLAN TO COOLAN THERMAL TO COOLAN TO COOLAN THERMAL TO COOLAN THERMAL TO COOLANT ELECTRICAL MEIGHT VOLUME					٠	TOTAL	KAX1MUM		TOTAL
TOTAL  D  1471 (500)  WATT (BTU/HR)  WATT (BTU/HR)  WATT (BTU/HR)  OPERATIONAL PENALTIES  HEAT LEAK  TO COOLANT  ELECTRICAL  MEIGHT  VOLUME	ly Her he		<u>. (' =</u> )	(BTU/HR)	(B)	407: 109	( <b>BT</b> U/HR) <i>I<sub>i</sub> :<sub>i /i /i</sub></i>		JTU/HR)
WATT (BTU/HR) WA	Mela					**************************************			
OPERATIONAL PENALTIES  THERMAL TO COOLANT ELECTRICAL MEIGHT VOLUME			TOTAL			•			
THERMAL TO COOLANT ELECTRICAL WEIGHT VOLUME				•			ه سمد د سمد		
HEAT LEAK TO COOLANT ELECTRICAL WEIGHT VOLUME				OPERALLON	AL - EI	HALILES	<u>i</u>		
	\$00	PRCE N/A	HEA	IT LEAK TO					VÖLUME <sup>3</sup> /MISSION)
}					•				
	}				·				

WATIS/CYCLE (BTU/HK/CYCLE) MYMISSION (FT YMISSION)

AG/MISSION (LL/MISSION)

WATTS/CYCLE (BTU/HR/CYCLE)

APPLIANCE CONCEPT REQUIREMENTS AND PENALTIES CALCULATIONS (CONCLUDED) INDEX NUMBER 3, 1 1, 10 MEIGHT/Y OLUME FIXED REQUIREMENTS VOLUME (FT) ML IGHT COMPONENT (LBS) 17 TOTAL 0.51 M3 (FT3) . KG (LBS) O (LB) MI/UNIT (PEF) (PKG.W//UNIT)(PEF) VOL/UNIT (REF)
(PKG. VOL/UNIT)(REF) 0 UNITS/CYCLE(RFF) (LB) Σ3 TOTAL WI/CYCLE (LB) De Joyal And Chere 10% DAYS/MISSION GAS/LIQUID EXPENDABLES REQUIREMENTS AMT. RECOVERED/CYCLE

(LB) AMT LOST/CYCLE (LB) · Ø 0 RECOVERY AMT. USED/CYCLE (REF) (LB) FACTOR Σ0 \_\_\_  $\Sigma$  $\odot$ 110 TOTALT DST/CYCLE (LB)

HABITABILITY SUBSYSTEM	3.0 Housekeeping
HABITABILITY FUNCTION	3.3 Garment/Linen Maintenance
APPLIANCE FUNCTION_	3.3.2 Garment/Linen Drying
NUMBER OF CONCEPTS CONSID	DERED9

#### **ASSUMPTIONS**

A number of references were found which present data for various clothes washer and dryer concepts (References 70, 90, 91, 100, 127, 161, 171, 185, 202, 237 and 245). These references were reviewed in detail, and the engineering data from each examined. It was soon found that much of the data did not agree. The primary reason for discrepancies was that the data were mostly very sketchy, without detailed breakdowns to define the data. For example, the clothes dryer weight in one reference would include the tub only, while another would include peripheral equipment such as heat exchanger, water separator, or other miscellaneous items. One reference was found (Ref. 90) which contained all the concepts found throughout the other reports and presented the data for each in a consistent manner for direct comparison. Therefore, it was decided to collect all the clothes washer and dryer data for this study from Reference 90.

A ground rule of two clothes washings/dryings per day was assumed from Reference 273. For this condition, and assuming a six-man Space Station crew, a detailed study of Space Station clothing usage (Reference 245) has shown a maximum laundry load of 1.66 kg (3.68 lbs). Since the clothes dryer load assumed in Reference 90 is only slightly larger than this, or 1.81 kg (4.0 lbs), the data from that reference were used directly without adjusting.

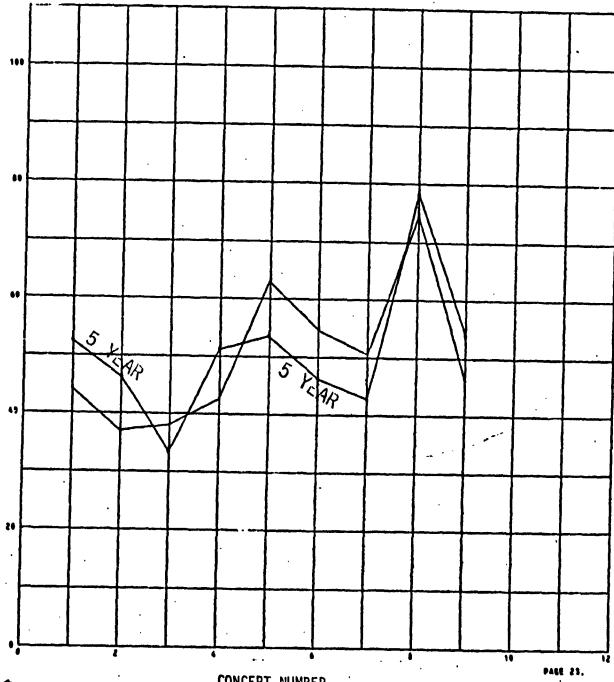
The dryers were assumed to remove 0.454 kg (1.0 lb) of residual water from the clothes, as specified in Reference 90. More testing is required to refine this assumption; however, data from Reference 202 indicate this enpurt of water may be too high. For most concepts, the drying time can be varied by sizing the hardware; e.g., one could choose a large heater for to the drying, or a smaller heater for slower drying. Based on the recommendation of Reference 237 and the Space Station system requirement in Reference 273, a drying time of 4 hours was assumed for these cases. Where applicable, ambient conditions are assumed to be 760 mm Hg (14.7 psia), 21.1°C (70°F) and 50 percent relative humidity. Wherever a component is connected directly to the cabin cooling circuit, it is assumed 85 percent of the energy transferred goes to the cooling circuit and 15 percent is heat leak to the cabin atmosphere.

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APPLIANCE
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1 - FORCED HOT AIR-ELECTRIC
2 - FORCED HOT AIR-HEAT FROM THERMAL STORAGE UNIT
3 - FORCED COLD DRY AIR-DISICCAMTIVACUUM REGENEMABLE)
4 - FOMOTO COLD DRY AIR-DISICCAMTIELECTRIC HEAT REGENERABLE)
5 - VACUUM DRY
6 - THERMAL VACUUM DRY-ELECTMIC HEAT
7, - THERMAL VACUUM DRY-THEMMAL STORAGE/RADIANT HEAT
8 - CLOTHES LINE-FORCED CONVECTION
9 - CLOTHES LINE-FORCED CONVECTION+ELECTRIC HEAT



4-3

CONCEPT NUMBER

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SINGLE SELECTION PARAMETER REGATING FACTOR BY -50 S  SINGLE SELECTION PARAMETER REGATING FACTOR BY -50 S  (BASED ON 100 S HAX POINTS)  (BASED ON 100 S HAX POINTS	SENSITIVITY ANALYSIS  RATING FOR EACH CONCEPT AFTER INCREASING  SINGLE SELECTION PARAMETER BEIGHTING FACTOR BY -50 8  [BASED ON 100 8 MAX POINTS]  C O N C E P T	
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APPLIANCE CONCEPT COMPONENT SUMMARY MATRIX

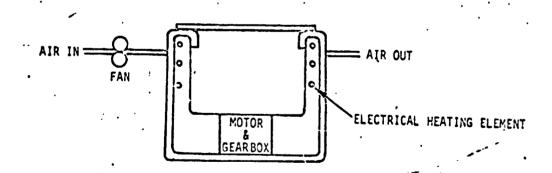
APPLIANCE F'NCTION: 3.3.2-GARMENT/LINEN DRYING

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	COMPONENT TO	APPLIANCE 17PE NO.	FORCED HOT AIR-ELEÇTRIC (pg. 51)	FORCED HOT AIR-HEAT FROM THERMAL STORAGE UNIT (pg. 55)	FORCED COLD DRY AIR-DESICCANT- VACUUM REGENERABLE (pg. 58)	FORCED COLD DRY AIR-DESICCANT ELECTRIC HEAT REGENERATION (pg. 61)	VACUUM DRY (pg. 64)	THERMAL VACUUM DRY-ELECTRIC HEAT (pg. 66)	THERMAL/VACUUM DRY-THERMAL STORAGE/RADIANT HEAT (pg. 68)	CLOTHES LINE-FORCED CONVECTION (pg. 72)	CLOTHES LINE-FORCED CONVECTION + ELECTRIC HEAT (pg. 74)		

SPACECRAF"	Space Station		
HABITABIL:	ITY SUBSYSTEM <u>Housek</u>	Garment/Linen eeping HABITABILITY FUNCTION Maintenance	
APPLIANCE	FUNCTION Garment	/Linen Drying	
APPLIANCE	CONCEPT NO./TITLE_	1/Forced Hot Air - Electric	
ĕNDEX NO	3.3.2.1	REF. NO90	

1

In this concept, a jet of air spray at  $60^{\circ}$ C (140°F) is directed into the clothes from outside the drum. The clothes are contained in a wire mesh drum which is rotated slowly in a direction counter to the air inlet. A prototype clothes dryer using this concept is described in Reference 237.



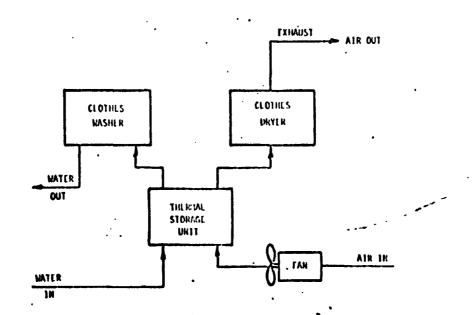
APPLIANCE CONCEPT REQUIREMENTS AND PENALTIES CALCULATIONS

(Ref # 90 1. 5	<u>air e</u> lect 1214)	ric			INDEX	NUMBER 3.3	. 2 1
Cher Jo Jo		CIRICAL	PQHER	REQUIR	· · · · · · · · · · · · · · · ·		_
COMPONENT (REF)  Modox  For	USE TIME CYCLE (HR)	PEAK (NATTS)  600	A C P O N E  3  AVERAGE (WATTS)	DEMAND (WATT-NR/ CYCLE) ① X ③	S PEAK (WATTS)	© PONE  AVERAGE (WATTS)	DEMANI (WATT-HE CYCLE)
					221		
·,		72 MAXIHUM		TOTAL	227 MAXIMUM	•	TOTAL
		 Inernal	REQUI	<u>R E M E N T S</u>	•	· .	
SOURCE		LATENT (BTU/.IR)		SIBLE U/HR)	HEAT LEAK (BTU/HR)		COOLANT TU/HR)
Motor		<del>C</del>		17	21		<del>.</del>
Hedre furter		2.65		27	117		<u></u>
`	TOTAL	77.6 (5.5) WATT (BTU/IIR)		(BTU/HR)	106 (24) MATT (BTU/HR)	-	F (675)
•		•			۰ سمری	•	· .
· . • •		OPERALLS	Dhal pe	MALILES			
source N/A		THERMAL AT LEAK BR/CYCLE) (E	TO COOLANT STU/HR/CYCLE)	ELECTRICAL (PK HATTS/CY			OLUME /HISSION)
	TOTAL WAT	ITS/CYLLE J/HH/CYCLE) (	MATTS/CYCLE BTI/HA/CYCLE)		KG/MISSI (LB/MISSI	DN H <sup>3</sup> /C ON) (FT <sup>2</sup> /	HISSION MISSION)

	Molar - Jectri	EPT REQUIREMENTS AND F C	Control of Control	INDEX . UMBE	R 3. 7. 5.1
(1:e1.* 7	ELXED	WEIGHT/YOLU!	4E REOUII	REMENIS	
DMPONENT	(REF)	•	MEIGHT (LBS)		AOF NWE
Diver			$I_{f^{\prime\prime}}$		17.1
Mill House	(contensing		1,	-	
H/X - willy	is water and				
<del>pachaging)</del>					
					•
		***************************************			
	TOTAL	30	3	0	50 (170)
			G (LBS)	The second second	M <sup>3</sup> (FT <sup>3</sup> ) .
•	SOLID EX		T/YOL REQ	UIREMENIS	, O
TYPE	① UNITS/CYCLE(REF)	WT/UNIT (REF) (PKG.WT/UNIT)(REF) (LB)	MI/CYCLE (LB)	VOL /UNIT (PEF) (PKG. VOL /UNIT)(REF) (FT <sup>3</sup> )	(FT 3)
N/A			**************************************		
		Σ3	TOTAL WY/CYCLE (LB)	. Σ	TÔTÀL VOÙ /CYCL F (FT 3)
TAL WT.	CLES/DAY D	AVS/MISSION X	TOT.WT/CYCLE	•	KG (LB)
	CLESTON	A13/1113310A	(LB)		NO (LD)
TAL VOL MISSION "CY	CLES/DAY X	AYS/MISSION X	YOT. VOL /CYCLE (FT3)	•	H <sup>3</sup> (FT <sup>3</sup> )
	<u>6 A S/L 1 Q U 1</u>	D <u>EXPENDAB</u>	LES REQU	IREMENTS	•
•		Φ	Ø	.RECOVERED/CYCLE	ANT LOST/CYCLE
TYPE	AHT.USED/	LYLLE(KE)	COVERY	(rg) (rg)	Φ <sub>(1,0)</sub>
				•	
•	Σ ①		· •	Σ 🛈 🗵	
TAL WT. 15510N -	KAPAA KARANTI KATANI	אל ור שנוסע <sup>א</sup> די אסן צג	W. F	·• [	KG (LB)

SPACECRAFT Space Station		Garment/Linen
HABITABILITY SUBSYSTEM Hous	ekeeping HABITABILITY FUNCTION	
APPLIANCE FUNCTION Garment/	Linen Drying	
APPLIANCE CONCEPT NO./TITLE_	2/Forced Hot Air - Thermal Stora	ge
INDEX NO. 3.3.2.2	REF. NO. 90	

This dryer concept is the same as Concept 1 except the electrical heater is replaced by a thermal storage unit which utilizes waste heat from the wash/rinse cycle. This concept should receive a credit for cooling the clothes washer water; however, this has been neglected. Clothes are dried by air at 49°C (120°F) from the thermal storage unit directed into the slowly revolving wire mesh drum.

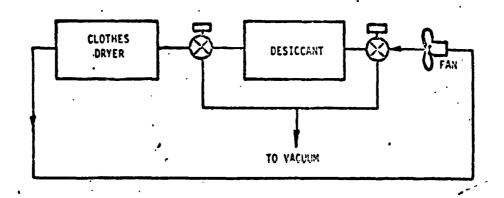


		RICAL P	OWER POWE	<u>require</u> R	MENIS	: POWES	<u>.                                    </u>
COMPONENT (REF)	USE TIME CYCLE (HR)	PEAK (WATTS)	③ AVERAGE (WATTS)	DEMAND (WATT-HR/ CYCLE) (DX(3)	(WATTS)	AYERAGE (WATTS)	(7) E HAND CYCL (YCC)
Lui	4	31					
		MAXIMUM .		TOTAL	MAXIMUM	•	TOTA
•,	•	•			•	•	•
		<u> THERMAL</u>	, PEOUIR	EHENIS	•		
SOURCE		LATENT (BTU/HR)	SENS (BTU	IRLE	HEAT LEAK (BTU/HR)		OOLANT
Moti	•	0	_ 21		212		•
For About 1		265	10		<u>105</u> <u>198</u>	_	<u>0</u>
`	TOTAL	77.6 (2.60)	401	13/0)	151 4 1	32.9	<u>(jy</u> a
		WATT (STU/HR)	WATT (I	BTU/HR)	WATT (BTU/HR)	WATT.	(BTU/HR
				:	سنع ر	•	
		PERATION	AL PE	 Baliles	-		
	. 0					, ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	LUME
SOURCE	_	THERMAL TO	COOLANT HR/CYCLE)	ELECTRICAL (PK WATTS/CYC	WEIGHT CLE) (LB/HISSI		
Source N/A	HEAT	THERMAL TO	COOL ANT HR/CYCLE)				
	HEAT	THERMAL TO	COOL ANT HR/CYCLE)				MISSION

(3 c/* *	$(g_{i,j}, g_{i,j}, g_{i,j})$		•			
	ELXED	METCHIA	LUME RE	<u>Q U 1 R E</u>	MENIS	
MPONENT	(REF)		WEIGHT (LBS)			VOLUME (FT <sup>3</sup> )
Lays.	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		. ?		****	
ئند لمستنبغ	·		10%	<del></del>	<del></del>	<del></del>
1/4. Ester	scharaler	·				<del>*</del>
packaging)						
		. —	·		<del></del>	
•						
<del></del>						
	TOTAL		81.6 (19	2) I		1.64 (22.7)
		•	KG (LBS)			M <sup>3</sup> (FT <sup>3</sup> ) .
٠,	SOLID EX	PENDABLE:	H I/X O F	REQUI	REMENTS	
	•	(2)	3		VOL/UNIT (REF)	YOL/CYÇLE
TYPE	① UNITS/CYCLE(REF)	WT/UNIT (REF) (PKG.WT/UNIT)(F (LB)	EF) ÛX (?	5 (	PKG. VOL/UNIT) (RE (FT3)	(f) (j) (d)
NIA		, , , , , , , , , , , , , , , , , , , ,	. (407		··· /	
,				-		
		•••••		-		
			<del></del>			
<del> </del>			<del></del>	<del></del> :-		-
	<del></del>				Σ	
			YOYAL WY/	CACLE	2	ADLYF AOF ACTE
AL NT.	_		(10)		<del></del>	\(\frac{1}{1}\)
2210%	YCLES/DAY X D	AVS/MISSION X	YOT WY/CYCL	<del></del>	l	- KG_(FB)
AL VOL			(LB)	_	ı——-	
15510NC	ACCERVANA X	AVS/MISSION 1	YOT. VOL /CYC	ir	L.,	N2 (13.1)
			(FT3)			,
						•
	EVZVTIONI	D EXPEND			EHENIS	
	ANT MEEN	<b>O</b>	RECOVERY	AMT . RE	CUAERED/CACFE	MIT LOST CYCLE
TYPE	MI.0350/	CYCLE (REF) ,	FACTOR		Or Ø	(re) O- ()
N/.	1		···			
<del></del>		<del></del>			<del></del>	
	Σ0	,	•	•	ΣΘ	
AL WT.		•				

SPACECRAFT Space Station	Garment/Linen
HABITABILITY SUBSYSTEM House	ekeeping HABITABILITY FUNCTION Maintenance
APPLIANCE FUNCTION Garment,	/Linen Drying
APPLIANCE CONCEPT NO./TITLE_	3/Forced Cold Dry Air-Desiccant-Vacuum Regenerab?
INDEX NO. 3.3.2.3	REF. NO90

In this concept, a closed loop of air circulates through a silica gel desiccant bed, where it is dried, and then through the clothes dryer tub where it dries the clothes. After the clothes are dried, space vacuum is used to dry the desiccant. The fan size is selected based on a 4-hour clothes drying time, and 4 hours are assumed for desiccant vacuum regeneration.



CONCEPT Figure 1 a le	APPL	IANCE CONCEPT	REQUIREMENTS ロモー V.C.C.C.C	S AND PENALTIES	s calculations raide	INDEX NUMBE	R 3.1.7.3
. (Ket. #90 p 5%	(a)	CIRLCAL	POWE		IREMENI		
	0			OWER	<del>,</del> –		POHER (7)
COMPONENT (REF)	USE TIM CYCLE (HR)	E ② PEAK (WATTS)	. AVERA ) (WATT	IGE (WATT-	-HR/ PE		6 DEMAND CRAGE (WATT-HR) CYCLE) ATTS) ① X ①
Valve Em	0.4	<u>55</u> 20					
		MAXIMUM	<del></del> .	TOTA	<del></del>	D	TOTAL
ORIGINAL PAGE IS- OF POOR QUALITY			· · · ·	· •	٠		
		IHERMA	LL. REQ	UIREMEN	<u>! I S</u>	٠	
SOURCE	•	LATENT (BTU/HR)	1	SENSIBLE (BTU/HR)		T LEAK U/HR)	TO COOL NT (BTU/HR)
Medox			···	2.17		12.	<u>· 0</u>
Fan Designed bed		. <u>0</u>		. 69 . 45	• •	<u>69</u> 45 ·	0
				· · · · · · · · · · · · · · · · · · ·			
	TOTAL	MATT (BTU/		75.2 (205 NATE (BTU/HR)		2 (325) (BTU/HR)	MATT (BTU/HR)
•		•	·			• ,	
•		. •	•	:		, m	•
','		QPERAI	TOMPF.	PENALI	I E S	<b>:</b> .	٠.
SOURCE	HE (BTU/i	THER AT LEAK IR/CYCLE)	MAL TO COOLAN (BTU/HR/CYC	1	RICAL TS/CYCLE) (I	WEIGHT LB/MISSION)	VOLUME (FT <sup>3</sup> /MISSION)
Tantage due to	· · · · · · · · · · · · · · · · · · ·	<u>.</u> .				104	9.6
<u> </u>			•		Marie and Marie And Annual Ann		
	IOTAL NA	C) TYS/CYCLE U/HR/CYCLE)	WATTS/CYCI (BTU/HR/CYC	LE	<u> </u>	7.2 (10/1) RG/MISSION B/MISSION)	0.272 (9.6)  M3/M15510N (FT3/M15510N)

	<u>E 1 X E D</u>	METCHIA O	LUME REQU	<u>IREMENTS</u>	
COMPONENT	(REF)		(LBS)		VOLUME (FT3)
Drue Part L			4-0	<del>.</del> -	•
Valves	•		<u>' / / / / / / / / / / / / / / / / / / /</u>		
					1
			. •		
	TOTAL	<del></del>	2:7 ()		0.55 (
PAGE		•	KG (LBS)		M³ (FT³) .
AL PAGE	SOLID EXI	PENDABLE	_ ~ ~ ~ ~ ~		<u>nis</u> D ©
<b>70</b> 10	① UNITS/CYCLE(REF)	WT/UNIT (REF (PKG.WT/UNIT)(I (LB)	(3) NT/CYCLE REF) (DX(2)	VOL/UNII (PKG.VOL/U (FT <sup>I</sup>	T (REF) VOL/ČÝ JNIT)(REF) ①X ( S) (FT3
N/A_	UNITS/CTCLE(REF)	(18)	. (LB)	(F1-	') (FI)
					Σ ⑤
		<b>6</b>	TOTAL WT/CYC	<u>re</u> .	TOTAL VOL
TOTAL WT	CYCLES/DAY DA	AYS/MISSION 1	XYOY.WT/CYCLE	_• [	KĠ (LB)
TOTAL VOL	•·····••••••••••••••••••••••••••••••••		(LB)		
MISSION	CYCLES/DAY X	AAS/WISZION 1	TOT.VOL/CYCLE (FT')	_ • L	M3 (FT3)
	•	•	,	_ • • •	
	<u> </u>	EXPEN!	DABLES RE	QUIREKEN	<u>I S</u>
`	AMT HEED/	(D)	- <b>②</b> . RECOVERY	AMT. RECOVERED/O	CYCLE AMT LOST/
Air lost to	AHT.USED/0 (1	LB)	FACTOR	①x② (LB)	(rg)
Water lost to	0.80	)			
					<del></del>
	Σ 0				ΣΦ

SPACECRAFT Space Station

HABITABILITY SUBSYSTEM Housekeeping HABITABILITY FUNCTION Maintenance

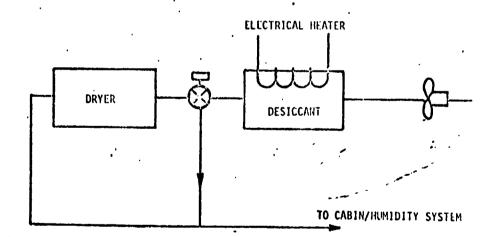
APPLIANCE FUNCTION Garment/Linen Drying

APPLIANCE CONCEPT NO./TITLE 4/Forced Cold Air-Desiccant-Heat Regenerable

INDEX NO. 3.3.2.4 REF. NO. 90

# DESCRIPTION

This concept is identical to Concept 3 except that the desiccant is regenerated by an electrical heater instead of vacuum.



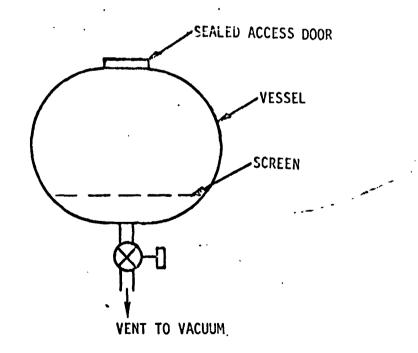
(Ref. #70 1. 61-6	( <sup>1</sup> )						
	FFFCI		<u>OWER</u>	REQUIRE	MENIS DO	POWE	
	USE TIME	② PEAK	P O W E  AVERAGE	ØEMÄND (WATT-HR/	⑤ PEAK	6 AVERAGE	(7) Demani (Watt-Hi
OMPONENT (REF)	(HR)	(WATTS)	(WATTS)	Ûx③ CYCLE)	(WATTS)	(WATTS)	CYCLE)
Valves Meter	$\frac{0}{1}$	672	<del></del>				
Tan	\$						
don't r					<u> 101                                  </u>		·
		<del></del>		<u> </u>		<del></del>	
			<del></del>				
		137	•		101	•	•
		MAXIMUM *	•	TOTAL	MAXIMUM		TOTAL
٠.					•		
	٠		. •		,	•	-
•		THERMAL	REQUI	R <u>ements</u>			
•		LATENT	SEN	SIBLE	HEAT LEAK	70	COULANT
y SOURCE		(BTU/HR)		1/HR)	(BTU/HR)		STU/HR)
Madai	<del></del>		2	12	2.12	_	. 0
<u>r</u> ,		. 0		63	69		0
Montey Minden		* 7,E		<u> </u>	$\frac{4r}{r}$		<u>2 %0</u>
						- ;	
		77.6 (265)	105	(31.)	95 (:: 1	 )	38 Cz
•	TOTAL	WATT (BTU/HR)		BTU/HR)	WATT (BTU/HR)		(BTU/HR)
•		•			•		
	•			: .		, , , , , , , , , , , , , , , , , , ,	
		,		•	منعم المعادين	•	•
	· <u>o</u>	PERATION	AL PE	NALTIES	•		ı
.•		THERMAL	•	ELECTRICAL	WEIGHT		OLUME
SOURCE	HEAT (BTU/HR/	LEAK TO CYCLE) (BTU	COOLANT /HR/CYCLE)	(PK WATTS/CYC			/MISSION)
N/A					•		
,	<del></del> -	<del></del>	<del></del>	<del></del>	··· ———		<del></del>
· · · · · · · · · · · · · · · · · · ·			•				
					· • • • • • • • • • • • • • • • • • • •		<del></del>
. 10	TAL WATT	S/CYCLE WA	TTS/CYCLE		KG/MISSI	ON M3/	MISSION

MEIGHT VOLUME (COMPONENT (REF) (LBS) (FT3)	GREE, # 90	. ,					
TOTAL 34.9 ()  SOLID EXPENDABLE MITTOUT RESULTEMENTS  WILLIAM OF THE MITTOUT RESULTEMENTS  WILLIAM OF THE MITTOUT RESULTEMENTS  WILLIAM OF THE MITTOUT RESULTEMENTS  WILLIAM OF THE MITTOUT RESULTEMENTS  WILLIAM OF THE MITTOUT RESULTEMENTS  WILLIAM OF THE MITTOUT RESULTEMENTS  WILLIAM OF THE MITTOUT RESULTEMENTS  WILLIAM OF THE MITTOUT RESULTEMENTS  WILLIAM OF THE MITTOUT RESULT RESULTEMENTS  WILLIAM OF THE MITTOUT RESULT RESULTEMENTS  WILLIAM OF THE MITTOUT RESULT RESULTEMENTS  WILLIAM OF THE MITTOUT RESULT RESULTEMENTS  WILLIAM OF THE MITTOUT RESULT RESULTEMENTS  WILLIAM OF THE MITTOUT RESULT RESULTEMENTS  WILLIAM OF THE MITTOUT RESULT RESULTEMENTS  WILLIAM OF THE MITTOUT RESULT RESULTEMENTS  WILLIAM OF THE MITTOUT RESULT RESULTEMENTS  WILLIAM OF THE MITTOUT RESULT RESULTEMENTS  WILLIAM OF THE MITTOUT RESULT RESULTEMENTS  WILLIAM OF THE MITTOUT RESULT RES	•	ETXE.D	WEIGHT/V		QUIRE	ENTS	
TOTAL 34.9 (***)  SOLID EXPENDABLE MIVEOL REQUEREMENTS  MYCHIP (REF)  OPENDATION (UNITS/CYCLE (REF) (PRG. WICKELE)  (FIG. WICK	COMPONENT	(REF)		(LBS)			(FT3)
TOTAL 34.9 ()  SOLID EXPENDABLE MINERAL WOLVENT (REF)  WATAMIT (REF)  MITAMIT	Driver	·				•	
TOTAL 34.9 ()  EQUID EXPENDABLE MIVEL REQUIREMENTS  MI/AMITS/CYCLE (REF)  MI/AMITS/CY	12. 15. be	<u> </u>	<del></del>				
TOTAL 34.9 ()  SOLID EXPENDABLE MIVOL REQUIREMENTS  WITHOUT (REF) WITHOUT (REF) WITHOUT (REF) WOLVESTORE  WITHOUT (REF) WITHOUT (REF) WITHOUT (REF) WOLVESTORE  WITHOUT (REF) WITHOUT (REF) WITHOUT (REF) WOLVESTORE  TOTAL WITHOUT (REF) WITHOUT (REF) WOLVESTORE  WISSION WITHOUT (REF) WITHOUT (REF) WOLVESTORE  TOTAL WITHOUT (REF) WOLVESTORE  TOTAL WITHOUT (REF) WOLVESTORE  WOLVESTORE  WOLVESTOR	131		***************************************			***************************************	
SOLID EXPENDABLE MI/VOL REQUIREMENTS  O WIT/LAIT (REF) WIZ/CICLE (PKG. VOL/UNIT) (REF) (	11. 1. 1			£5		•	
SOLID EXPENDABLE MI/VOL REQUIREMENTS  O WIT/LAIT (REF) WIZ/CICLE (PKG. VOL/UNIT) (REF) (							
SOLID EXPENDABLE MIVOL REQUIREMENTS  O WITHOUT (REF) WIVE (REF) (PRO VOLUNT) (REF) (PRO V				· · · · · · · · · · · · · · · · · · ·	<del></del> -	•	
SQLID EXPENDABLE MIVOL REQUIREMENTS  O WITHOUT (REF) WIVE (REF) (PRG. WITHIT) (REF) (LB)  TYPE UNITS/CYCLE(REF)  N/A  DAYS/RISSION X TOTAL VOLVECTE (LB)  O WITHIT (REF) WIVE (REF) (FT3)  TOTAL VOLVECTE (LB)  TOTAL VOLVECTE (LB)  O WITHIT (REF) WIVE (REF) (RE						•	
SQLID EXPENDABLE MIVOL REQUIREMENTS  O WITHOUT (REF) WIVE (REF) (PRG. WITHIT) (REF) (LB)  TYPE UNITS/CYCLE(REF)  N/A  DAYS/RISSION X TOTAL VOLVECTE (LB)  O WITHIT (REF) WIVE (REF) (FT3)  TOTAL VOLVECTE (LB)  TOTAL VOLVECTE (LB)  O WITHIT (REF) WIVE (REF) (RE						•	
SOLID EXPENDABLE MIVOL REQUIREMENTS  O WITHOUT (REF) WIVE (REF) (PRO VOLUNT) (REF) (PRO V			·	- <u> </u>	<del></del>	<u></u>	
SOLID EXPENDABLE MIVOL REQUIREMENTS  MIVALITY (REF.)  MIV		TOTAL	` <u></u>		',)	0	<del></del>
TYPE  WITTS/CYCLE (REF)  WITTS/CYCLE (REF)  WITTS/CYCLE (REF)  (PKG. WITTS/CYCLE (REF)  (PKG. WITTS/CYCLE (PKG. WITTS/CYCLE  (LB)  TOTAL WITTCYCLE  TOTAL WITTCYCLE  (LB)  TOTAL WITTCYCLE  RG (LB)  TOTAL WITTCYCLE  RG (LB)  TOTAL WITTCYCLE  RG (LB)  TOTAL WITTSION  TOTAL WITTCYCLE  RG (LB)  TOTAL WITTCYCLE  RG (LB)  TOTAL WITTCYCLE  RG (LB)  TOTAL WITTCYCLE  RG (LB)  TOTAL WITTCYCLE  RG (LB)  TOTAL WITTCYCLE  RG (LB)  TYPE  MITTUSED/CYCLE (REF)  ANTITUSED/CYCLE (REF)  RECOVERY  FACTOR  TYPE  MITTUSED/CYCLE  MITTUSED/C			•	KG (LBS)			M3 (FT3)
TYPE UNITS/CYCLE(REF) (PKG.WT/UNIT)(REF) (LB) (PKG.WOL/UNIT)(REF) (VOL/CYCLE (PKG.WOL/UNIT)(REF) (LB) (PKG.WOL/UNIT)(REF) (PKG		SOLID EX	PENDABLE	W T/V O L	REOUI	REMENTS	•
TYPE UNITS/CYCLE(REF) (PKG. VIJ.UNIT) (REF) (LB) (PKG. VOL.UNIT) (REF) (DX (PKG. VOL.UNIT) (REF) (DX (PKG. VOL.UNIT) (REF) (PKG. VOL		TIERE ED.	<u> </u>	Œ		<b>(A)</b>	<b>③</b>
TOTAL NT.  WISSION  CYCLES/DAY  DAYS/HISSION  TOTAL VOL  HISSION  CYCLES/DAY  AMT. USCD/CYCLE (REF)  AMT. USCD/CYCLE (REF)  TYPE  AMT. USCD/CYCLE (REF)  TYPE  AMT. USCD/CYCLE (REF)  FACTOR  TYPE  AMT. RECOVERED/CYCLE  (LB)  TYPE  AMT. RECOVERED/CYCLE  (LB)  TYPE  AMT. RECOVERED/CYCLE  (LB)  TYPE  AMT. RECOVERED/CYCLE  (LB)  TYPE  AMT. RECOVERED/CYCLE  (LB)  TYPE  AMT. RECOVERED/CYCLE  (LB)  TYPE  AMT. RECOVERED/CYCLE  (LB)  TYPE  AMT. RECOVERED/CYCLE  (LB)  TYPE  AMT. RECOVERED/CYCLE  (LB)  TYPE  AMT. RECOVERED/CYCLE  (LB)  TYPE  AMT. RECOVERED/CYCLE  (LB)			WT/UNIT (RE (PKG.WT/UNIT)	F) WT/CYC (REF) ①X(2	LE (F	VOL/UNIT (REF) KG.VOL/UNIT)(REF)	) ①x.④
TOTAL NT.  TOTAL NT.  TOTAL VOLVEYCRET  TOTAL VO		UNITS/CYCLE(REF)	(LB)	, (LB)		(FT3)	(FT³)
TOTAL KT.  MISSION  CYCLES/DAY  DAYS/HISSION  TOTAL VOL  MISSION  CYCLES/DAY  DAYS/HISSION  TOTAL VOL  MISSION  CYCLES/DAY  DAYS/HISSION  TOT.VOL/CYCLE  (LB)  CYCLES/DAY  DAYS/HISSION  TOT.VOL/CYCLE  (FT3)  AMT. USED/CYCLE (REF)  AMT. USED/CYCLE (REF)  AMT. USED/CYCLE (REF)  AMT. USED/CYCLE (REF)  AMT. USED/CYCLE (REF)  AMT. USED/CYCLE (REF)  AMT. USED/CYCLE  (LB)  TYPE  AMT. USED/CYCLE  (LB)  TOTAL VOL  (LB)  AMT. RECOVERED/CYCLE  (LB)  AMT. RECOVERED/CYCLE  (LB)  AMT. RECOVERED/CYCLE  (LB)  TYPE  AMT. USED/CYCLE  (LB)  TOTAL VOL  (LB)  TOTAL VOL  (LB)  TOT. VOL/CYCLE  (LB)  AMT. RECOVERED/CYCLE  (LB)  TOTAL VOL  (LB)  TOTAL VOL  (LB)  TOTAL VOL  (LB)  TOTAL VOL  (LB)  TOTAL VOL  (LB)  TOT. VOL/CYCLE  (LB)  TOTAL VOL  (LB)  TOT. VOL/CYCLE  (LB)  TOTAL VOL  (LB)  TOT. VOL/CYCLE  (LB)  TOTAL VOL  (LB)  TOT. VOL/CYCLE  (LB)  TOTAL VOL  (LB)  TOTA	N/H	-					
TOTAL KT.  MISSION  CYCLES/DAY  DAYS/HISSION  TOTAL VOL  MISSION  CYCLES/DAY  DAYS/HISSION  TOTAL VOL  MISSION  CYCLES/DAY  DAYS/HISSION  TOT.VOL/CYCLE  (LB)  CYCLES/DAY  DAYS/HISSION  TOT.VOL/CYCLE  (FT3)  AMT. USED/CYCLE (REF)  AMT. USED/CYCLE (REF)  AMT. USED/CYCLE (REF)  AMT. USED/CYCLE (REF)  AMT. USED/CYCLE (REF)  AMT. USED/CYCLE (REF)  AMT. USED/CYCLE  (LB)  TYPE  AMT. USED/CYCLE  (LB)  TOTAL VOL  (LB)  AMT. RECOVERED/CYCLE  (LB)  AMT. RECOVERED/CYCLE  (LB)  AMT. RECOVERED/CYCLE  (LB)  TYPE  AMT. USED/CYCLE  (LB)  TOTAL VOL  (LB)  TOTAL VOL  (LB)  TOT. VOL/CYCLE  (LB)  AMT. RECOVERED/CYCLE  (LB)  TOTAL VOL  (LB)  TOTAL VOL  (LB)  TOTAL VOL  (LB)  TOTAL VOL  (LB)  TOTAL VOL  (LB)  TOT. VOL/CYCLE  (LB)  TOTAL VOL  (LB)  TOT. VOL/CYCLE  (LB)  TOTAL VOL  (LB)  TOT. VOL/CYCLE  (LB)  TOTAL VOL  (LB)  TOT. VOL/CYCLE  (LB)  TOTAL VOL  (LB)  TOTA							
TOTAL VOL  MISSION  CYCLES/DAY  AMT. USED/CYCLE (LB)  TOTAL VOL  MISSION  CYCLES/DAY  AMT. USED/CYCLE (REF)					<del></del>		
TOTAL VOL  MISSION  CYCLES/DAY  AMT. USED/CYCLE (LB)  TOTAL VOL  MISSION  CYCLES/DAY  AMT. USED/CYCLE (REF)			<del></del>				
TOTAL VOL  MISSION  CYCLES/DAY  AMT. USED/CYCLE (LB)  TOTAL VOL  MISSION  CYCLES/DAY  AMT. USED/CYCLE (REF)							
TOTAL VOL  MISSION  CYCLES/DAY  DAYS/MISSION  TOTAL VOL  MISSION  CYCLES/DAY  DAYS/MISSION  TOTAL VOL  CYCLES/DAY  DAYS/MISSION  TOTAL VOL  MISSION  CYCLES/DAY  DAYS/MISSION  TOTAL VOL  CYCLES/DAY  DAYS/MISSION  TOTAL VOL  (LB)  CYCLES/DAY  DAYS/MISSION  TOTAL VOL  (LB)  TOTAL VOL  (LB)  CYCLES/DAY  DAYS/MISSION  TOTAL VOL  (LB)  TOTAL VOL  (LB)  TOTAL VOL  (LB)  KG (LB)  KG (LB)  MJ (FTJ)  AMT LOST/CYCLE  (LB)  TYPE  AMT LUSED/CYCLE (REF)  (LB)  TYPE  AMT LUSED/CYCLE (REF)  (LB)  TOTAL VOL  (L							
TOTAL VOL  MISSION  CYCLES/DAY  DAYS/MISSION  TOTAL VOL  MISSION  CYCLES/DAY  DAYS/MISSION  TOTAL VOL  MISSION  TOTAL VOL  CYCLES/DAY  DAYS/MISSION  TOTAL VOL  (FT3)  AMT. USED/CYCLE (REF)  TYPE  AMT. USED/CYCLE (REF)  FACTOR  TYPE  AMT. USED/CYCLE (REF)  FACTOR  TYPE  AMT. USED/CYCLE (REF)  FACTOR  TYPE  AMT. USED/CYCLE (REF)  FACTOR  TYPE  AMT. USED/CYCLE (REF)  FACTOR  TYPE  AMT. USED/CYCLE (REF)  FACTOR  TYPE  AMT. USED/CYCLE (REF)  FACTOR  TYPE  AMT. USED/CYCLE (REF)  FACTOR  TYPE  AMT. USED/CYCLE (REF)  FACTOR  TYPE  AMT. USED/CYCLE (REF)  FACTOR  TYPE  AMT. USED/CYCLE (REF)  FACTOR  TYPE  AMT. USED/CYCLE (REF)  FACTOR  TYPE  AMT. USED/CYCLE (REF)  FACTOR  TYPE  AMT. USED/CYCLE (REF)  FACTOR  TYPE  AMT. USED/CYCLE (REF)  FACTOR  TYPE  AMT. USED/CYCLE (REF)  FACTOR  TYPE  AMT. USED/CYCLE (REF)  FACTOR  TYPE  AMT. USED/CYCLE (REF)  FACTOR  TYPE  AMT. USED/CYCLE (REF)  FACTOR  TYPE  AMT. USED/CYCLE (REF)  TYPE  AMT. USED/CYCLE (REF)  FACTOR  TYPE  AMT. USED/CYCLE (REF)  TYPE  AMT. USE			•		CYCLE	. <b>2</b> 6	YOTAL VOLYCYCLE
CYCLES/DAY  DAYS/HISSION  TOY.WI/CYCLE (LB)  CYCLES/DAY  AMT.USED/CYCLE(REF)  AMT.USED/CYCLE(REF)  AMT.USED/CYCLE(REF)  AMT.USED/CYCLE(REF)  FACTOR  CYCLES/DAY  TOY.WI/CYCLE  M³ (FT³)  AMT.RECOVERY  FACTOR  (LB)  TYPE  AMT.USED/CYCLE (LB)  TYPE  AMT.USED/CYCLE (LB)  TYPE  AMT.USED/CYCLE (LB)  TYPE  AMT.USED/CYCLE (LB)  TYPE  AMT.USED/CYCLE (LB)  TYPE  AMT.USED/CYCLE (LB)  TYPE  AMT.USED/CYCLE (LB)  TYPE  AMT.USED/CYCLE (LB)  TYPE  AMT.USED/CYCLE (LB)  TYPE  AMT.USED/CYCLE (LB)  TYPE  AMT.USED/CYCLE (LB)	TOTAL LT			(LB)	)		(F13)
TOTAL YOL  MISSION  CYCLES/DAY  DAYS/MISSION  TOY.VOL/CYCLE  (FT3)  AMT. USED/CYCLE (FT3)  AMT. USED/CYCLE (REF)  TYPE  AMT. USED/CYCLE (REF)  (LB)  FACTOR  (LB)  TOY.VOL/CYCLE  (FT3)  AMT. RECOVERED/CYCLE  AMT. RECOVERED/CYCLE  (LB)  TOY.VOL/CYCLE  (FT3)  AMT. RECOVERED/CYCLE  (LB)  TOY.VOL/CYCLE  (FT3)  AMT. RECOVERED/CYCLE  (LB)  TYPE  AMT. USED/CYCLE (REF)  (LB)  TYPE  AMT. USED/CYCLE (REF)  (LB)  TYPE  AMT. USED/CYCLE (REF)  (LB)  TYPE  AMT. USED/CYCLE (REF)  (LB)  TYPE  AMT. USED/CYCLE (REF)  (LB)  TYPE  AMT. USED/CYCLE (REF)  (LB)  TYPE  AMT. USED/CYCLE (REF)  (LB)	MISSION	XX	NC III CCTAB	XYAY LATICVE	<del></del>		VC 71.6\
TYPE  AMT. USED/CYCLE (REF)  AMT. USED/CYCLE (REF)  AMT. FACTOR  TYPE  AMT. DAYS/MISSION  TOT. VOL/CYCLE (FT3)  TOT. VOL/CYCLE (FT3)  AMT. RECOVERY (LB)  AMT. RECOVERED/CYCLE (LB)  AMT. RECOVERY (LB)  TYPE  AMT. LOSS/CYCLE (LB)	CYC	rres/ny) o	412/M12510N	(LB)	. L		KG (CG)
TYPE  AMT. USED/CYCLE (REF)  AMT. USED/CYCLE (REF)  AMT. FACTOR  TYPE  AMT. DAYS/MISSION  TOT. VOL/CYCLE (FT3)  TOT. VOL/CYCLE (FT3)  AMT. RECOVERY (LB)  AMT. RECOVERED/CYCLE (LB)  AMT. RECOVERY (LB)  TYPE  AMT. LOSS/CYCLE (LB)	TOTAL VOL	¥		¥	•		desired the second section of the section of the secti
GAS/LIQUID EXPENDABLES REQUIREMENTS  OMAT. USED/CYCLE (REF) RECOVERY AMT. RECOVERY (LB)  AMT. USED/CYCLE (REF) FACTOR  FACTOR  TYPE  N/A   D  OMAT. USED/CYCLE  (LB)  TYPE  N/A	CYC		AYS/MISSION	TOY. VOL/CYC	IE	L	My (FY)
TYPE  ANT. USED/CYCLE (REF)  (LB)  FACTOR  ANT. RECOVERED/CYCLE  ANT. RECOVERED/CYCLE  (LB)  ANT. RECOVERED/CYCLE  (LB)  TYPE  (LB)		•					
TYPE  ANT. USED/CYCLE (REF)  (LB)  FACTOR  ANT. RECOVERED/CYCLE  ANT. RECOVERED/CYCLE  (LB)  ANT. RECOVERED/CYCLE  (LB)  TYPE  (LB)							•
TYPE  AMT. USED/CYCLE (REF)  FACTOR  (LB)  TYPE  (LB)  TACTOR  (LB)  TACTOR  (LB)  TACTOR  (LB)  TACTOR  (LB)  TACTOR  (LB)		G A S/L 1 Q V I I	<u>EXPEN</u>				•
TYPE ANT. USED/CYCLE (REF) FACTOR (LB) (LB)  TYPE (LB)  FACTOR  FACTOR  FACTOR  TYPE		•	Φ		AMT.REC	OVERED/CYCLE	AMT LOST/CYCLE
ΣΦ	TYPE	AMT.USED/(	CYCLE(REF) , LB)		(	① X ② (LB)	$0^{(18)}$
•	N	A	,		·		
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	,		•			• 1	

SPACECRAFT	Space Station	
HABITABILI	TY SUBSYSTEM House	Garment/Linen keeping HABITABILITY FUNCTION Maintenance
APPLIANCE	FUNCTION Garment/	Linen Drying
APPLIANCE	CONCEPT NO./TITLE_	5/Vacuum Dry
INDEX NO.	3.3.2.5	REF. NO. 90

O

In this concept, clothes are simply sealed in a tub which is vented to space vacuum. The water will first treeze due to rapid evaporation, after which the ice will gradually sublime from the heat of conduction and radiation through the structural walls. Drying time is assumed, according to Reference 90, to be 6.35 hours.

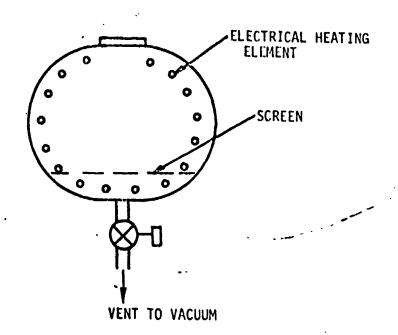


CONCEPT Vacium de	APPL1	ANCE CONCEPT	REQUIREMEN	NIS AND	PENALTIES CAL	CULATIONS INDE	( NUMBER	2.3.2.5
(Ref. # 90 p	(4, 65)					•		-
•	ETEC	IRICAL			REQUIR			
	USE TIME		A C	POWE	R DEMAND	0		OWER (7)
COMPONENT (REF)	USE TIME CYCLE (HR)	PEAK (WATTS	) (W	(3) ERAGE ATTS)	DEMAND (WATT-HR/ CYCLE) ① X ③	(WATTS)	AVERA (WATT	GE (WATT-HR/ CYCLE)
		55	<u> </u>				•	
		MAXIMU		•	TOTAL	MAXIMUM		TOTAL
٠,				•	·			
		THERM	AL, RE	Q <u>U</u> 1!	REMENIS		•	•
•		LATENT		SEN	SIBLE	HEAT LEAK		TO COOLANT
* SOURCE		(BTU/HR)	)		J/HR)	(BTU/HR)		(BTU/HR)
N/A			•,					
		<u> </u>		,			<del>.</del>	
<del></del>	<del></del> '	·					<u>-</u>	
			<del></del> -		<del></del>	•	—	
`	TOTAL		<u> </u>		•	****	·	
•		WATT (BTU/	HR)	WATT (	BTU/HR)	MATT (BTU/HR	)	WATT (BTU/HR)
•				·	,	٠ •	•	•
· · .		<u>Q P E R A I</u>	10 <u>nal</u>	. PE	Malii:	3		
SOURCE	HE. (B1U/H	THEF AT LEAK IR/CYCLE)	MAL TO COOL (BTU/HR/C	ANT YCLE)	ELECTRICAL (PK HATTS/C			VOLUME (FT <sup>3</sup> /MISSION)
Tankage due to		<u> </u>	0					9.8.
)								,
. 1	DTAL NAT	TS/CYCLE J/HR/CYCLE)	WATTS/C (BTG/HR/	ACTE)	<b></b>	48.1 KG/MISS (LB/MISS	(106) ION ION)	0.278 (9.8) K3/MISSION (FT3/MISSION)

TOTAL 18.6 (1.5)  RG (1.85)  RG (	ONCEPT Variety	APPLIANCE CONCLE	PT REQUIREMENTS AND PENALT	TIES CALCULATIONS.	(CONCLUDED)  INDEX NUMBER	3.3.2.5
TOTAL TS. 6  TOTAL	(Ref. # 9	o p (1,66)				
TOTAL 18.6 (LBS) (FT2)  NOTAL 18.6 (LBS)  REQUIREMENTS  SQLID EXPENDABLE MUVOL REQUIREMENTS  MICHAEL (RBS)  MICHAEL (RBS)  NOTAL WITCHILE (RBC)  WITCHILE (RBC)  WITCHILE (RBC)  (LB)  TOTAL WITCHILE (RBC)  (LB)  TOTAL WITCHILE (RBC)  WOLGERIA  (RBS)  TOTAL WITCHILE (RBC)  WOLGERIA  (RBS)  TOTAL WITCHILE  CYCLES/DAY  X DAYS/RISSION X TOT. MICHAEL  CYCLES/DAY  X DAYS/RISSION X TOT. MICHAEL  CYCLES/DAY  X DAYS/RISSION X TOT. MICHAEL  MICHAEL (RBC)  MICHAEL		<u> FIXED</u>	E 1 G H T/Y O L U M E	REQUIREM		
TOTAL    18.6   1.1   1.2   1.2   1.2   1.3   1.	OMPONENT TO A PART OF THE PART	(REF)	(LBS	S)	·	OLUME FT <sup>3</sup> )
TOTAL    18.6   1.1   1.20   77   78   79   79   79   79   79   79	Valve					
TOTAL    18.6   1.1   1.20   77   78   79   79   79   79   79   79				······································		
TOTAL    18.6   1.1   1.20   77   78   79   79   79   79   79   79						
TOTAL    18.6   1.1   1.20   77   78   79   79   79   79   79   79						
TOTAL    18.6   1.1   1.2   1.2   1.3   1.						
SOLID EXPENDABLE MIVOL REQUIREMENTS  O MT/UNIT (REF) OXO (F12)  TYPE UNITS/CYCLE(REF) (PKG.MT/UNIT)(REF) OXO (F12)  MTAL MT.  CYCLES/DAY X DAYS/MISSION X TOT.WT/CYCLE (LB)  MISSION CYCLES/DAY X DAYS/MISSION X TOT.WT/CYCLE (LB)  MISSION CYCLES/DAY X DAYS/MISSION X TOT.WT/CYCLE (LB)  MAT. USED/CYCLE(REF) RECOVERY (F12)  MAT. USED/CYCLE(REF) RECOVERY (LB)  AMT. USED/CYCLE(REF) RECOVERY (LB)  MISSION O CYCLES/DAY A DAYS/MISSION X TOT. WG. /CYCLE (MISSION O CYCLES/DAY X DAYS/MISSION X TOT. WG. /CYCLE (MISSION O CYCLES/DAY X DAYS/MISSION X TOT. WG. /CYCLE (MISSION O CYCLES/DAY X DAYS/MISSION X TOT. WG. /CYCLE (MISSION O CYCLES/DAY X DAYS/MISSION X TOT. WG. /CYCLE (MISSION O CYCLES/DAY X DAYS/MISSION X TOT. WG. /CYCLE (MISSION O CYCLES/DAY X DAYS/MISSION X TOT. WG. /CYCLE (MISSION O CYCLES/DAY X DAYS/MISSION X TOT. WG. /CYCLE (MISSION O CYCLES/DAY X DAYS/MISSION X TOT. WG. /CYCLE (MISSION O CYCLES/DAY X DAYS/MISSION X TOT. WG. /CYCLE (MISSION O CYCLES/DAY X DAYS/MISSION X TOT. WG. /CYCLE (MISSION O CYCLES/DAY X DAYS/MISSION X TOT. WG. /CYCLE (MISSION O CYCLES/DAY X DAYS/MISSION X TOT. WG. /CYCLE (MISSION O CYCLES/DAY X DAYS/MISSION X TOT. WG. /CYCLE (MISSION O CYCLES/DAY X DAYS/MISSION X TOT. WG. /CYCLE (MISSION O CYCLES/DAY X DAYS/MISSION X TOT. WG. /CYCLE (MISSION O CYCLES/DAY X DAYS/MISSION X TOT. WG. /CYCLE (MISSION O CYCLES/DAY X DAYS/MISSION X TOT. WG. /CYCLE (MISSION O CYCLES/DAY X DAYS/MISSION O CYCLES/DAY X DAYS/MISSION O CYCLES/DAY X DAYS/MISSION X TOT. WG. /CYCLE (MISSION O CYCLES/DAY X DAYS/MISSION O CYCLES/DAY	· · · · · · · · · · · · · · · · · · ·			·	•	
TYPE UNITS/CYCLE (REF) (PKG.WT//WIT) (REF) (LB) (PKG.VOL//WIT) (REF) (LB) (FT3)  TOTAL WT.  CYCLES/DAY X DAYS/MISSION X TOT.VT/CYCLE (LB)  CYCLES/DAY X DAYS/MISSION X TOT.VT/CYCLE (FT3)  CYCLES/DAY X DAYS/MISSION X TOT.VT/CYCLE (TT3)  CYCLES/DAY X DAYS/MISSION X TOT.VT/		TOTAL				
TYPE UNITS/CYCLE(REF) (PRG. VOI./VOIT) (REF) (LB) (PRG. VOI./VOIT) (REF) (LB) (PRG. VOI./VOIT) (REF) (LB) (PRG. VOI./VOIT) (REF) (LB) (PRG. VOI./VOIT) (REF) (LB) (PRG. VOI./VOIT) (REF) (LB) (PRG. VOI./VOIT) (REF) (LB) (PRG. VOI./VOIT) (REF) (REF) (REF) (REF) (REF) (REF) (REF) (REF) (REF) (REF) (RECOVERY (REF) (RECOVERY (LB) (LB) (LB) (LB) (LB) (LB) (LB) (LB)	•	SOLID EXP	ENDABLE HIV	OL REQUI	<u>.</u> R <u>EMENIS</u>	•
TYPE  ATT. USE OF TOTAL WITCHCLE  TOTAL WIT.  TOT. WITCHCLE  TOTAL WIT.  TOT. WITCHCLE  TOTAL WIT.  TOT. WITCHCLE  TOTAL WIT.  TOT. WITCHCLE  TOTAL WIT.  TOT. WITCHCLE  TOTAL	TAPL		(PKG.WT/UNIT)(REF)	ONT/CYCLE OX (P	VOLJUNIT (REF)	() X (4) () X (4) () T (7)
TAL WIT.  ATAL WIT.  ATAL WIT.  ATAL WOL  WITSSTON  CYCLES/DAY  ANT. USED/CYCLE (REF)  ANT. USED/CYCLE (REF)  ANT. USED/CYCLE (REF)  ANT. USED/CYCLE (REF)  ANT. USED/CYCLE (REF)  ANT. USED/CYCLE (REF)  ANT. USED/CYCLE (REF)  ANT. USED/CYCLE (REF)  ANT. USED/CYCLE (REF)  ANT. USED/CYCLE (REF)  ANT. USED/CYCLE (REF)  ANT. USED/CYCLE (REF)  ANT. USED/CYCLE (REF)  ANT. USED/CYCLE (REF)  ANT. USED/CYCLE (REF)  ANT. USED/CYCLE (REF)  ANT. USED/CYCLE  ANT. USED/CYCLE (REF)  ANT. USED/	NJA					
TAL WIT.  TOTAL WI						
TAL WIT.  ATAL WIT.  ATAL WIT.  ATAL WOL  WITSSTON  CYCLES/DAY  ANT. USED/CYCLE (REF)  ANT. USED/CYCLE (REF)  ANT. USED/CYCLE (REF)  ANT. USED/CYCLE (REF)  ANT. USED/CYCLE (REF)  ANT. USED/CYCLE (REF)  ANT. USED/CYCLE (REF)  ANT. USED/CYCLE (REF)  ANT. USED/CYCLE (REF)  ANT. USED/CYCLE (REF)  ANT. USED/CYCLE (REF)  ANT. USED/CYCLE (REF)  ANT. USED/CYCLE (REF)  ANT. USED/CYCLE (REF)  ANT. USED/CYCLE (REF)  ANT. USED/CYCLE (REF)  ANT. USED/CYCLE  ANT. USED/CYCLE (REF)  ANT. USED/						
TAL WIT.  ATAL WIT.  ATAL WIT.  ATAL WOL  WITSSTON  CYCLES/DAY  ANT. USED/CYCLE (REF)  ANT. USED/CYCLE (REF)  ANT. USED/CYCLE (REF)  ANT. USED/CYCLE (REF)  ANT. USED/CYCLE (REF)  ANT. USED/CYCLE (REF)  ANT. USED/CYCLE (REF)  ANT. USED/CYCLE (REF)  ANT. USED/CYCLE (REF)  ANT. USED/CYCLE (REF)  ANT. USED/CYCLE (REF)  ANT. USED/CYCLE (REF)  ANT. USED/CYCLE (REF)  ANT. USED/CYCLE (REF)  ANT. USED/CYCLE (REF)  ANT. USED/CYCLE (REF)  ANT. USED/CYCLE  ANT. USED/CYCLE (REF)  ANT. USED/						
TAL WIT.  ATAL WIT.  ATAL WIT.  ATAL WOL  WITSSTON  CYCLES/DAY  ANT. USED/CYCLE (REF)  ANT. USED/CYCLE (REF)  ANT. USED/CYCLE (REF)  ANT. USED/CYCLE (REF)  ANT. USED/CYCLE (REF)  ANT. USED/CYCLE (REF)  ANT. USED/CYCLE (REF)  ANT. USED/CYCLE (REF)  ANT. USED/CYCLE (REF)  ANT. USED/CYCLE (REF)  ANT. USED/CYCLE (REF)  ANT. USED/CYCLE (REF)  ANT. USED/CYCLE (REF)  ANT. USED/CYCLE (REF)  ANT. USED/CYCLE (REF)  ANT. USED/CYCLE (REF)  ANT. USED/CYCLE  ANT. USED/CYCLE (REF)  ANT. USED/					<b>7</b> 0	
TALL UT.  CYCLES/DAY  DAYS/MISSION  TOT.NT/CYCLE  (LB)  TOT.NT/CYCLE  (LB)  TOT.NT/CYCLE  (LB)  TOT.NT/CYCLE  (LB)  TOT.NT/CYCLE  (LB)  TOT.NT/CYCLE  (LB)  TOT.NT/CYCLE  (LB)  TOT.NT/CYCLE  (LB)  TOT.NT/CYCLE  (LB)  TOT.NT/CYCLE  (LB)  TOT.NT/CYCLE  (LB)  TOT.NT/CYCLE  (LB)  AMT.USED/CYCLE(REF)  (LB)  TYPE  AMT.USED/CYCLE(REF)  (LB)  FACTOR  (LB)  TOT.NT/CYCLE  (LB)  AMT.USED/CYCLE(REF)  (LB)  TALL NO.  TYPE  AMT.USED/CYCLE(REF)  (LB)  TALL NO.  TALL NO.  TOT.NT/CYCLE  (LB)  TOT.NT			<b>2</b> 9 <sub>10</sub>	TAL WT/CYCLE (LB)	. <b>2</b> 0.	TOTAL VOL /CYCLE (FT3)
TYPE  ANT. USED/CYCLE (REF)  TYPE  ANT. USED/CYCLE (REF)  ANT. USED/CYCLE (REF)  ANT. OS. J. O. S. O.	OTAL WT.	x	x	•	[	
CYCLES/DAY  DAYS/MISSION  TOY.VOL/CYCLE (FT3)  GAS/LIQUID EXPENDABLES REQUIREMENTS  DAYS/MISSION  TOYPE  ANT.USED/CYCLE(REF) (LB)  ANT.USED/CYCLE(REF) (LB)  FACTOR  TYPE  ANT.USED/CYCLE(REF) (LB)  TYPE  ANT.USED/CYCLE(REF) (LB)  TYPE  ANT.USED/CYCLE (LB)  TYPE  AN	CYC	LES/DAY DAY	YS/MISSION TOT.	NT/CYCLE (LB)	K	(LB)
GAS/LIQUID EXPENDABLES REQUIREMENTS  OMAT. USED/CYCLE(REF) RECOVERY ANT. RECOVERD/CYCLE ANT LOST/CYCLE  TYPE (LB) FACTOR (LB)  LICE LOST CONTROL CONTR	MISSION "	X	X XXX	uai revet e		
TYPE  ANT. USED/CYCLE (REF)  (LB)  ANT. RECOVERY  RECOVERY  (LB)  ANT. RECOVERY  (LB)  ANT. RECOVERY  (LB)  (LB)  TALL MIT. RECOVERY  (LB)  ANT. RECOVERY  (LB)  ANT. RECOVERY  (LB)  (LB)  TALL MIT. RECOVERY  (LB)  ANT. RECOVERY  (LB)  ANT. RECOVERY  (LB)  ANT. RECOVERY  (LB)  ANT. RECOVERY  (LB)  ANT. RECOVERY  (LB)  ANT. RECOVERY  (LB)  ANT. RECOVERY  (LB)  ANT. RECOVERY  (LB)  (LB)	CYC	LES/DAY DAY	15/M1551UN 10:.1	(FT <sup>3</sup> )	۲۱۰ مرمده	(11-)
TYPE  ANT. USED/CYCLE (REF)  (LB)  ANT. RECOVERY  RECOVERY  (LB)  ANT. RECOVERY  (LB)  ANT. RECOVERY  (LB)  (LB)  TALL MIT. RECOVERY  (LB)  ANT. RECOVERY  (LB)  ANT. RECOVERY  (LB)  (LB)  TALL MIT. RECOVERY  (LB)  ANT. RECOVERY  (LB)  ANT. RECOVERY  (LB)  ANT. RECOVERY  (LB)  ANT. RECOVERY  (LB)  ANT. RECOVERY  (LB)  ANT. RECOVERY  (LB)  ANT. RECOVERY  (LB)  ANT. RECOVERY  (LB)  (LB)						•
TYPE  ANT. USED/CYCLE (REF)  FACTOR  ANT. RECOVERTY  TYPE  ANT. USED/CYCLE (REF)  FACTOR  ANT. RECOVERTY  TALL Loss for the space (LB)  FACTOR  ANT. RECOVERTY  TALL Loss for the space (LB)  TALL Loss for the space (L			<u> </u>		_	0
Δir lost to space 0.076 0.80 ΣΦ	THEF	AMT.USED/C	y	RY ANT.REC	OVERED/CYCLE	AMT LOST/CYCLE
ΣΦ	Air lost to	mace0.0	76	·		(10)
NTAL MT.	eter let to s	0.8	0			
ITAL NT.						
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TAL MT.		Σ 0			Σ • _	· · · · · · · · · · · · · · · · · · ·
OMENIA TO A TOP A	TAL UT.	x 184	,	_	٠٢	146 (322

SPACECRAFT_	Space Sta	tion	-	Common h // inon
<b>HABIT</b> ABILIT	Y SUBSYSTEM	Housekeeping	HABITABILITY	Garment/Linen FUNCTION Maintenance
APPLIANCE F	UNCTIONG	arment/Linen Dry	/ing	
APPLIANCE CO	ONCEPT NO./	TITLE6-Thermal \	acuum Dry - El	ectric Heat
INDEX NO.	3.3.2.6		REF., NO. 9	)

This concept is identical to Concept 5 except that an electrical heater has been added to provide additional heat to aid the sublimation process. Heater size was based on a drying time of 4 hours to be consistent with the other concepts.



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, sec. 1	_	CIRICAL	POWER AC POW	REQUIR!	EMENIS DC	POWER
COMPONENT (REI	USE TIME CYCLE F) (HR)	E ② PEAK (MATTS)	. AVERAGE (WATTS)	DEMAND (WATT-HR/ CYCLE) ① X ③	⑤ PEAK (WATTS)	DI AVERAGE (MAT (WATTS)
Vestor	4				90	
			<u> </u>	· · · · · · · · · · · · · · · · · · ·	,	
	-			• • • • • • • • • • • • • • • • • • • •		
		55 MAXIMUM		TOTAL	90 MAXIMUM	10
٠, .			•			· •
		IHERMA	L REQUI	LREMENTS	:	•
. SOURCE		LATENT (BTU/HR)		INSIBLE ITU/HR)	HEAT LEAK (BTU/HR)	TO COOLAN (BTU/HR)
Herton		0	••	45	45.	
•	TOTAL	MATT (BTU/H		2 (45) (BTU/HR)	13.2 (14.5) MATT (BTU/HR)	) <u>O</u> WATT (BTU/
•		•	,		• • •	· .
• •				• •		• •
		O P E R A T I	•	ENALILES		
SOURCE		FAT LEAK HR/CYCLE)	TO COOLANT	ELECTRICAL (PK HATTS/CY		VOLUME (FT³/HISSI
lankan due to		<u> </u>				6 9.8
			•	-		
					•	
•	TOTAL WA	O TTS/CYCLE U/HR/CYCLE)	O WATTS/CYCLE (BTU/MK/CYCLE)		48.1 () KG/MISSIO (LB/MISSIO	106) 0.278 (9 m 193/195510 m) (ft'/191551

APPLIANCE CONCEPT REQUIREMENTS AND PENALTIES CALCULATIONS (CONCLUDED)

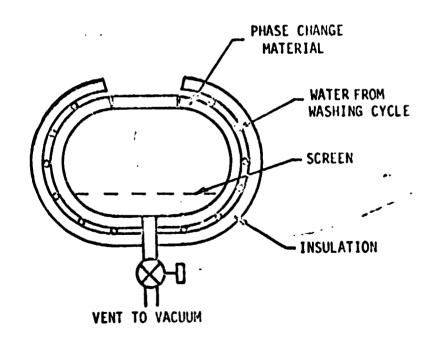
INDEX NUMBER 3, 3, 2.6 concept Thermal vacuum dry - electric WEIGHT/VOLUME FIXED REQUIREMENTS WEIGHT (LBS) VOLUME COMPONENT (REF) TOTAL 0.23 (56) M3 (FT3) KG (LBS) 5 O L 1 D EXPENDABLE MINOF REQUIREMENTS MT/UNIT (REF) VOL/UNIT (REF) (PKG.WT/UNIT)(REF) (PKG. VOL/UNIT) (PEF) UNITS/CYCLE(REF) TYPE  $\Sigma$   $\odot$ YOTAL WT/CYCLE (LB) YOTAL VOL/CYCLE TOTAL WT. DAYS/HISSION - X -TOY.WT/CYCLE (LB) CYCLES/DAY MISSION . DAYS/MISSION CYCLES/DAY M2.(127). 6 A S/L 1 Q U I D EXPENDARLES ANT. RECOVERED/CYCLE

Ox

(LB) AMT LOST/CYCLE 0 RECOVERY AMT.USED/CYCLE(REF) Air lost to space 0.0.76  $\Sigma \odot$  $\Sigma \odot$ TOYAL TOSY/EVELE & O (LB)

SPACECRAFT Space Station	Garment/Linen
HABITABILITY SUBSYSTEM Housekeeping	HABITABILITY FUNCTION Maintenance
APPLIANCE FUNCTION Garment/Linen D	rying
	l Vacuum Dry-Thermal Storage-Radiant Heat
	REF. NO. 90
INDEX NO. 3.3.2.7	KEF. NV.

This concept is identical to Concept 6 except that the electrical heater is replaced by a thermal storage unit which stores the heat from the wash and rinse water. Clothes are sealed in a tub which is vented to space vacuum, and the energy required for sublimation provided by the thermal storage unit. A drying time of 4 hours was assumed.

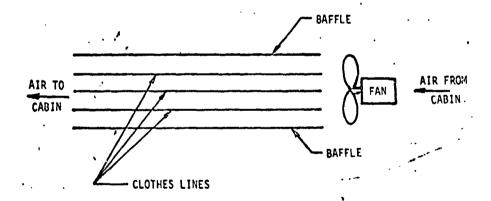


CONCEPT 11.1	190 p 68.	ttime dry.	- HALYMAN	storey -	1/21,00	INDEX NU	MBER 7.3.2.7
\$ 8° <b>\$ \$</b>	70 p 68.	EFEEI	RICAL	POWER	FEGUIRE	EMENIS	
		Φ	A	C POVE		<u> </u>	POWER
COMPONENT Verilia Component	(REF)	USE TIME CYCLE (HR)	② PEAK (MATTS) 55	③ AVERAGE (WAT™)	DEMAND (WATT-HR/ CYCLE)  (D X (3)	=	O DEMAND AVERAGE (WATT-HR, CYCLE) (WATTS) ① X ①
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						·	
			<u> 55</u>	•		_0_	•
,			MAXIMUM '	•	TOTAL	MAXIMM	TOTAL
•	•					•	
		•		•			<b>-</b> '
		:	IHERMAL	REQUI	Remenis	•	•
. sou	RCE		LATENT (BTU/HR)		SIBLE U/HR)	MEAT LEAK (STU/HR)	10 COOLANT (BTU/HR)
Thompsi	Jan 19	:1	•	•	4.5	4 Z; .	. ()
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						<del></del>	
•		TOTAL .	() -		(42)	13.2 (45)	<u></u>
•			WATT (BTL/HR)	WATT	(BTU/HR)	MATT (BTU/HR)	MATT (BTU/HR)
	•		•			•	
•	•	•			: .	المراجعين	• •
		•		•	• •		
•		. 0	PERAILO	MAL PE	MALILES	•	•
so	UNCE	HEAT (BTU/HR/	THERMAL LEAK TO CYCLE) (BTO	O COOLANT U/HR/CYCLE)	ELECTRICAL (PK MATTS/C/		, (L13/H12210#)
Tunk	1 20	(	Ď	0.	O	106	9.4
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			<del></del>				···
•	10	OTAL WATT	O SZCYCLE W	C'	<u> </u>	48.1 (1:	() 0.278 9.8
	•	(676,	T/CYLLE) (D	TU/MR/CYCLE)		KG/MISSION (LR/MISSION	) (FT3/MISSION)

·	ELXED	METEHIA	OLUME RE WEIGHT	QUIREME	M I S	VOLUME
MPOHENT	(REF)		(LBS)			VOLUME (FT3)
olye					·	
		-		•		
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<del></del>				<del></del>		
	TOTAL	. L.		1)	0.2	
•			KG (LBS)		•	M3 (FT3) ·
•	FOFTD EXT	ENDABLE	M IVA O F	REQUIR	MENIS	,
	Φ	WT/UNIT (RE (PKG.WT/UNIT)	(3) (1) WT/CY(1) (1) (1) (1) (1) (1)	LE VOI	(4) L/UNIT (REF) VOLVUNITI/PEF)	VOL/CYCLE
TYPE	UMITS/CYCLE(REF)	(LB)	(REF) DX (LB)	, tras	VOL/UNIT) (REF)	(LL3)
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,		•	- YOYAL 1877 . (LB)	CYCLE	. 20	TOTAL VOLVEYOR
AL WT.	•			•	<del></del>	
	CLES/DAY D	THISSION	101.NY/CYCL (LD)	<del>r</del>	<del></del>	KG (LB)
AL VOL	¥		¥	•	,	
<b>C</b> VI	CLES/BAY D	NS/MISSION	107.VOL/CYC (FT*)	17		13 (17) THE
			• •	•		• •
	6 A 5/L 1 Q U 1 S	EIZEN	PARLES 2	EQUIRE	IRMIS	
•	(	<b>D</b>	. 🛮	ANT . RECOV	D CACT E	AMT LOST/CYCLE
TYPE	AMT.USED/C	YCLE (REF)	RECOVERY FACTOR	Φ	(D)	0.0
11 150 15 m	2.750 Q.D	76		-·		
der let 1	0.5					
,	ΣΦ		<del>-</del>	- <del></del>	Σω	
		-				

SPACECRAFT	Space Station		•		
HABITABILITY	SUBSYSTEM Hous	ekeeping H	<b>ABITABILITY</b>	FUNCTION	Garment/Linen Maintenance
APPLIANCE FU	INCTION Garme	nt/Linen Dryi	ng	_	
	NCEPT NO./TITLE	8/Clothesline	e-Forced Conv	vection	
INDEX NO.	3.3.2.8		REF. NO.	90	

In this concept, clothes are attached (with pins, snaps, velcro, etc.) to wide mesh screen panels which are stacked in parallel racks. A fan is used to force air between the panels to dry the clothes. Crew time would be relatively high compared with the other concepts. Drying time was assumed to be 8 hours.

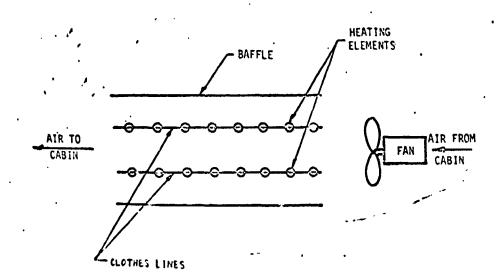


TOTAL 39	(WATTS) 7 MAXIMUM	SEN (BT	TOTAL  REMENT  ISIBLE  TU/HR)	PEAK (HATTS)  O  MAXIMUM	(BT)	DEMA (WATT- CYCLE ① X(  TOTAL
CYCLE COMPONENT (REF) (HR)  FIN  SOURCE  TOTAL  3.9  MA	PEAK (HATTS)  7  MAXIMUM  LE R M A L  LATENT (BTU/HR)  ()  13 3	REQUI	TOTAL  REMENT  ISIBLE  SU/HR)	PEAK (HATTS)  O MAXIMUM  S HEAT LEAK (BTU/HR)	AVERAGE (WATTS)  TO CC (BT)	TOTAL
SOURCE TOTAL 39	TO MAXIMUM LATENT (BTU/HR)	REQUI	TOTAL  REMENT  ISTBLE  TU/HR)	O MAXIMUM  S HEAT LEAK (BTU/HR)  24	TO CC (BT)	TOTA
SOURCE TOTAL 3.7	ERMAL  LATENT (BTU/HR)  ()  13.3	SEN (BT	<u>R E M E N T</u> ISIBLE IU/HR)	MAXIMUM  S  HEAT LEAK (BTU/HR)	(BT)	OOLANT U/HR)
SOURCE  TOTAL 39  WA	ERMAL  LATENT (BTU/HR)  ()  13.3	SEN (BT	<u>R E M E N T</u> ISIBLE IU/HR)	MAXIMUM  S  HEAT LEAK (BTU/HR)	(BT)	OOLANT U/HR)
SOURCE  TOTAL 39  WA	ERMAL  LATENT (BTU/HR)  ()  13.3	SEN (BT	<u>R E M E N T</u> ISIBLE IU/HR)	MAXIMUM  S  HEAT LEAK (BTU/HR)	(BT)	OOLANT U/HR)
SOURCE  TOTAL 39  WA	ERMAL  LATENT (BTU/HR)  ()  13.3	SEN (BT	<u>R E M E N T</u> ISIBLE IU/HR)	MAXIMUM  S  HEAT LEAK (BTU/HR)	(BT)	OOLANT U/HR)
SOURCE TOTAL 39	ERMAL  LATENT (BTU/HR)  ()  13.3	SEN (BT	<u>R E M E N T</u> ISIBLE IU/HR)	MAXIMUM  S  HEAT LEAK (BTU/HR)	(BT)	OOLANT U/HR)
SOURCE TOTAL 39	ERMAL  LATENT (BTU/HR)  ()  13.3	SEN (BT	<u>R E M E N T</u> ISIBLE IU/HR)	MAXIMUM  S  HEAT LEAK (BTU/HR)	(BT)	OOLANT U/HR)
SOURCE  TOTAL 39  WA	ERMAL  LATENT (BTU/HR)  ()  13.3	SEN (BT	<u>R E M E N T</u> ISIBLE IU/HR)	MAXIMUM  S  HEAT LEAK (BTU/HR)	(BT)	OOLANT U/HR)
SOURCE  TOTAL 39  WA	LERMAL  LATENT (BTU/HR)	SEN (BT	<u>R E M E N T</u> ISIBLE IU/HR)	S HEAT LEAK (BTU/HR)	(BT)	OOLANT U/HR)
SOURCE  TOTAL 39  WA	LATENT (BTU/HR)  C 133	SEN (BT	ISIBLE IU/HR)	HEAT LEAK (BTU/HR)	(BT)	U/HR) - ()
SOURCE TOTAL 39	LATENT (BTU/HR)  C 133	SEN (BT	ISIBLE IU/HR)	HEAT LEAK (BTU/HR)	(BT)	U/HR) - ()
SOURCE TOTAL 39	LATENT (BTU/HR)  C 133	SEN (BT	ISIBLE IU/HR)	HEAT LEAK (BTU/HR)	(BT)	U/HR) - ()
SOURCE  TOTAL 39	LATENT (BTU/HR)  C 133	SEN (BT	ISIBLE IU/HR)	HEAT LEAK (BTU/HR)	(BT)	U/HR) - ()
TOTAL 39	(BTU/HR)  ()  13.3	(BT	(U/HR)	(8TU/HR)	(BT)	U/HR) - ()
TOTAL 39	733			24	· . (	· ()
TOTAL 39	133		24			
TOTAL 39				133		<u>()</u>
WA					· · · · · · · · · · · · · · · · · · ·	
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WA	0 / 122	7.0	· (p4)	46.0 (15	·~)	Ó
•	TT (BTU/HR)		(BTU/HR)	WATT (BTU/H		BTU/H!
	(210)		(0.0)	water (Didylia	· ************************************	(BIO/III
	•		•			
	•	*	: .			
	•					
	ERATIONA	AL PE	MALIIE	E <b>S</b>	. <u>.</u>	•
	THERMAL			•	•	
SOURCE HEAT LE	AK TO C	COOLANT HR/CYCLE)	ELECTRIC (PK WATTS/			LUME MISSIOI
/ (BIO/AR/CTO	TE) (BIO)H		(PK WATES)	, (CB/H13:	2104) (1.1.)	M13310
<i>N/A</i>					, .	_ <u>·</u>
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					·	

CONCEPT <u>C/ell</u>	line - Forced	T REQUIREMENTS AND PENALTIES TONVOCTION	·	INDEX NUMBER 3.3.3.6
	ELXED W	EIGHT/YOLUME	EQUIREMEN	<u>I I S</u>
COMPONENT	(REF)	WEIGHT (LBS)		VOLUME (FT 3)
Dryer		25		130
Ean				
	•			
				•
				•
	TOTAL			3.68 (1:4)
		KG (LBS)		M3 (FT3)
••	SOLID EXP	ENDABLE WI/YOL	REQUIRE	MENTS
	TELLE EAL	മ		O S UNIT (REF) VOL/CYCLE
	Φ	(PKG.WT/UNIT)(REF)	CYCLE VOL/S X ② (PKG.Y	UNIT (REF) VOL/CYCLE OL/UNIT)(REF) ①X④ (FT³) (FT³)
TYPE / A	UNITS/CYCLE(REF)	(LB) (	X ② (PKG. V LB)	OL/UNIT)(REF) ①x④ (FT³) (FT³)
N/A	·			
·····				
<del></del>	· <del></del>			······································
· · · · · · · · · · · · · · · · · · ·				
		Σ③	WT/CYCLE	Σ ⑤
•		. (	WT/CYCLE LB)	YOTAL VOL/CYCLE (FT3)
TAL WT.	x	<b>x</b> .		
CYC	LES/DAY DAY	S/MISSION TOT.WT/C (LB)	YCLE	KG (LB)
TAL VOL		(10)	_	
MISSION CYC	CLES/DAY X DAY	TOT.VOL/	CYCLE	M <sub>3</sub> (FT <sub>3</sub> )
	•	. (FT <sup>3</sup>	)	and the second second
			•	
	<u>6 A S/L I Q U I D</u>	EXPENDABLES	REQUÍREM	ENIS
•	· o	. ②	AMT. RECOVER	)
	AMT.USED/CY		AMI. NECOVER ① X ( (LB	FD/CYCLE AMT LOST/CYCLE O
TYPE A1/	Δ , (LB	FACTOR	. (LB	(LB)
······································	<u> </u>	• .	<del></del> •	
<del></del>		•		
	<u> </u>			70
•	Σ ①	*		Σ ⊚
		•	•	
TAL WT.	YDAY X —DAYS7HISS	TOTAL LUSY/CYCLE		KG (LB)

SPACECRAFT	Space Station	and the second s		
HABITABILITY	SUBSYSTEM Housekeepi	ng HABITABILIT	Y FUNCTION	Garment/Linen Maintenance
APPLIANCE FU	NCTION <u>Garment/Linen</u>	Drying		
APPLIANCE CO	NCEPT NO./TITLE 9/Clo	thesline-Forced Co	nvection p	lus Electric Heat
INDEX NO	3.3.2.9	REF. NO.	90	
DESCRIPTION	•			

This concept is identical to Concept 8 except that an electrical heating element has been added within the clothes panels to expedite the drying process. Heater size is based on a drying time of 4 hours.



(Ref. # 72 p)		A C	<u> </u>		MENIS DC	POWER	t
MPONENT (REF)	USE TIME CYCLE (HR) 4	PEAK (WATTS)	③ AVERAGE (WATTS)	DEMAND (WATT-HR/ CYCLE) (1) x (3)	⑤ PEAK (WATTS)	AVERAGE (WATTS)	7) DEMA - 1141.) SYCLE (1) X (1)
ir is	4				216		
N				,	/	•	<del> </del>
		MAXIMUM .	•	TOTAL	MAXIMUM		TOTA
•		.·			•		•
					•	•	
		IHERMAL.	REQUI	REMENTS	•		•
s SOURCE		LATENT (BTU/HR)		SIBLE J/HR)	HEAT LEAK (BTU/HR)		OOLANT U/HR)
lenter / ar		265		<u>10</u> 08	777		<del>,</del>
			<del></del>				
<del></del>			*********		•	· . ——	
\	TOTAL	77.6(265)	121	·(C:E)	259/003	·	·,
	IUIAL	MATT (BTU/HR)		STU/HR)	WATT (BTU/HR)		(BTU/HF
•		•	•		· • .		
		•		•	ومعرب	•	•
		<u> </u>	AL PE	NALTIES			
•	LAP.	THERMAL	•	ELECTRICAL	WEIGHT	*vo	LUME
SOURCE		AT LEAK TO IR/CYCLE) (BTU)	COOLANT HR/CYCLE)	(PK HATTS/CYC			MISSION
\/A		· · · · · · · · · · · · · · · · · · ·					
·							

	EIXED	MET.BHIA	OLUME RE	QUIREM.	ENTS	
1PONENT	(REF)		WEIGHT (LBS)			VOLUME (FT <sup>3</sup> )
Style be			7/			140
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	TOTAL		18.1 /	$L_{f,r}$	3.	96 (12)
			KG (LBS)			M3 (FT3)
••	SOLID EXP	ENDABLE	W T/Y O L	REQUIR	EMENTS	,
		WT/UNIT (RE	(E) PLY(C)	CLE VI	OL/UNIT (REF)	VOL/CYCLE
TYPE	① UNITS/CYCLE(REF)	(PKG.WT/UNIT)	(REF) ①X(	Ž (PK	G.VCL/UNIT)(RE	F) ①x ② (FT³)
N/A				· 		
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			•			
····						- <del> </del>
			$\Sigma$ ③	76V61 E	· Σ	5) TOTAL WOLVEYO
			TOTAL WI	)		TOTAL VOLVEYO
AL WT.	CLES/DAY DA	YS/MISSION	X	•		KG (LB)
	GEES/UNT DA	13/1133101	(LB)			KU (LD)
AL VOL ISSION ————————————————————————————————————	CLES/DAY X DA	YS/MISSION	XYOY UNITED	• •		M3 (FT3)
Cit	GLES/DAT DA	13/11331011	101.VOL/CY (FT3)	CLL		~ (r) ~
	•		,	•	20.00	•
• • • •	G A S/L 1 Q U 1 D	EXPEN		REQUIRT	MENIS	
		D	<b>?</b> Recovery	AMT . RECO	AERED/CACLE	MI LOST CYCLE
TYPE	AMT.USED/C	B)	FACTOR	U	(LB)	(LB)
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	$\Sigma$ 0		·•		$\Sigma \odot$	

# D2-118561-5

HABITABILI	ITY SUBSYS	TEM	3.0 Housek	eeping ·		
HABITABILI	ITY FUNCTIO	ON3.3	<u>Garment/Linen</u>	Maintenance		
<b>A</b> PPL IANCE	FUNCTION_	3.3.3	Garment/Linen	Washer/Dryer-Dis	posable	Clothes
NUMBER OF	CONCEPTS	COMSIDERE	9	•		

#### **ASSUMPTIONS**

For this appliance function, the most promising individual clothes washer concepts (Section 4.3.1) were combined with the most promising clothes dryer (Section 4.3.2) to form integrated clothes washer/dryer units. The data for each case were taken directly from the data sheets for Section 4.3.1 and 4.3.2. Washer and dryer data were combined, and the redundant components eliminated. Peak power and thermal requirements were taken to be the maximum for the individual washer and dryer, rather than the sum of the two, since each is operated at separate times.

The washer/dryer combinations were compared with disposable clothes. Clothes wear rates and weights assumed with a washer/dryer were taken from Reference 237 and 245 and are shown in Table C2-7. A clothes weight packaging factor of 1.31, and clothes packaged volume, are taken from Reference 100. This resulted in a total clothes/linens size of 61.2 kg (135 lbs) and 0.725 cu m (25.6 cu ft) required for a six-man crew with an automatic clothes washer/dryer. The clothes required for the disposable case were computed from a wear rate of 2.88 kg (6.366 lbs) per day, with the volume again taken from Reference 100.

TABLE C2-7 CLOTHES/LINENS USAGE RATES ASSUMED PER MAN WITH A CLOTHES WASHER/DRYER AVAILABLE

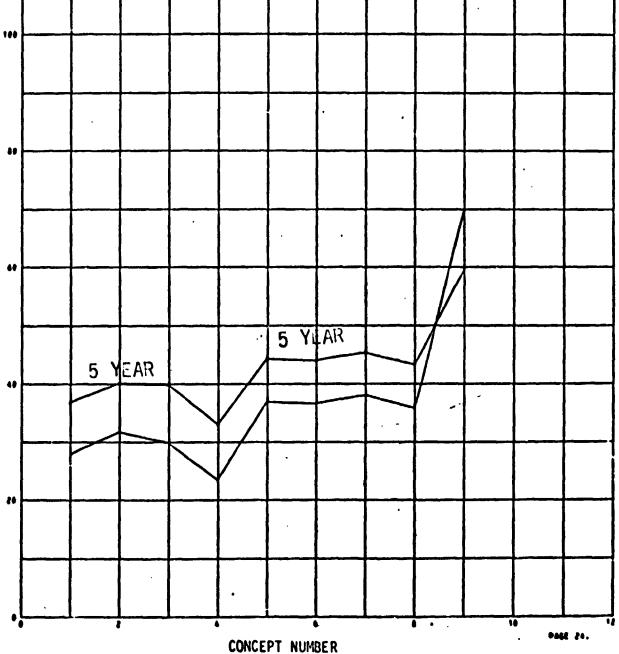
ITEM	WEAR INTERVAL	NUMBER	ARTICLE WEIGHT	WEIGHT 1b	TOTAL WEIGHT	IGHT 16
Short sleeve shirt	3 days	4	0.20	0.45	0.82	1.80
Trousers	7 days	ო	.54	1.20	1.63	3.60
Jacket	7 days	m	.50	1.10	1.50	3.30
Undershorts/sox/shirt	2 days	9	, 26	.57	1.55	3.42
Shoes (pr.)		က	.31	69.	.94	2.07
Gloves	21 days	က	.08	.17	.23	.51
Towels	1 day	7	.10	.23	.73	1.61
Washcloth	.5 day	12	.035	.077	.42	.92
Total			2.035	4.50	7.82	17.23

		MTS DEVELOPHENT RESUPPLY COST	"VE AVAIL INDEX HEIGHT " (se) (se) " " (LBS) " (LBS)	11.32 3 60 10.9	59,451	5:01 3 70 18:9 176:751 41:01	5-29 3 60 10.0	1131 2 40 1819	1.44 3 65 14.02	170.253	1106415) 2 40 16.9	6.21 1 0 678.6 [290.00] [196.03			
		REGHTS WT/VOL REGHTS	AVE PER ELIGIT VOL. OC. +KG4 - CC		.0 ( 625.5) ( 5	.0 328.2 .0 (723.5) (174	0 ( ) (3.5.6	.0 (527.5) (40	.0 ( 432.5) 1 51	.0 ( \$37.5) (174	.0 1 527.53 118	•0 •03.4			
# # # # # # # # # # # # # # # # # # #	(SPACE STATION)	ELEC PRR	A P P P P P P P P P P P P P P P P P P P	237.0	237.0	237.0	237.0	237.0	237.0	237.0	237.0	00			
	CL014ES	THERMAL REGISTS	COOLANT LEAK ************************************	198. 1470.	( 1120.) (5020.)	( 0.) (5020.)	( 000 (80200)	198. 1470.	( 1120.) (5020.)	0. 1470. ( 0.) (5020.)	1 0.1 (5020.)	0 1. 6.0			
APPLIANCE CO	BASHER/ORYER-DISPOSABLE	REGUIRENENTS	PARTS TELEFORMATION OF THE PARTS TO THE PART	0.0	100. 1 00. 1	0. 1 (0. 1	0. 1 (0. )	0. 1 (0. 1	0. 1 (0. 1	0. 1 0. 1	0. 1 [0. ]				
: :	GARRENT/LINEN B	ES AND FLOS	ANT: FLOR USED FLOR -KG/USE: (10/USE) (*)	00* 0000011	110,000011 .001	44.8460 .00	10.00001	00. 0000011	10.00001	100.00001	100.000001		OH Der	GINAU 1 POOR QU	A
	H NO. 3.3,5	Jevsn	SES/DAY 17PE #S/USE [0]	011 000*g	\$.000 110	2.000 + 44 4.000 110	\$.000 \$ \$.000 110	2.000 • • • • • • • • • • • • • • • • • •	\$.000	2.000 T T	011 000-5	9000			4
	rjoni	CONCEPT	. 1	-		•		•		•		•			

AIR-ELFCTRIC MEATER (*)  DATING-CLOTHES LINE  DATING-CLOTHES LINE  DATING-CLOTHES LINE  DATING-CLOTHES LINE  HOT AIR-ELECTRIC MEATER  3 - CABIN AIR (LOST)  KG/HR  4 - COOLING WATER (LOST)  KG/HR  4 - COOLING WATER (LOST)  KG/HR  5 - WATER  (LOST)  KG/HR  6 - NITROGEN  (LOST)  KG/HR  7 - NITROGEN  KG/HR  8 - FREON  (CIRCULATED)  KG/HR  KG/HR  7 - NITROGEN  KG/HR  8 - FREON  KG/HR  KG/H	(4) EXTENSIVE DEV. REQUIRED 75-1002	
TCUDIC AGITATION/FORCED HOT AIR  TCUDIC AGITATION/FORCED AIR DRITT  TCUDIC AGITATION/FORCED AIR DRITT  TCUDIC AGITATION/FORCED AIR DRITT  TCUDIC AGITATION/FORCED AIR DRITT  TCUDIC AGITATION/FORCED AIR DRITT  TCUDIC AGITATION/FORCED AIR DRITT  TCUDIC AGITATION/FORCED AIR AIR SPRAY AGITATION/FORCED AIR DRITT  TCUDIC AGITATION/FORCED AIR BATCH SPRAY AGITATION/FORCED AIR DRITTALION/FORCED AIR DRIT	HEIGH AL OULLES.	

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APPI TANCE
     CONCEPT
    .. NO.
                FLUIDIC AGITATION/FORCED HOT AIR-ELECTRIC HEATER
                FLUIDIC AGITATION/FORCED HOT AIR-THERHAL STOTAGE HEATER FLUIDIC AGITATION/FORCED AIR DRYING-CLOTHES LINE
                FLUIDIC AGITATION/FONCED AIR DRYING-CLOTHES LINE
                MATER SPRAY AGITATION/FOPCED HOT AIR-ELECTRIC HEATER
                MATER SPRAY AGITATION/FORCED HOT AIR-THERMAL STORAGE HEATER
                MATER SPRAY AGITATION/FORCED AIR DRYING-CLOTHES LINE
              WATER SPRAY AGITATION/ELECTRICALLY HEATED-CLOTHES LINE
           - DISPOSABLE CLOTHES
```



Garment/Linen Washer/Dryer-Disposable Clothes (Space Station) Concept Trade C2-574

100/16/75)  100/16		768617 768617 7
104/14/751	100/10/75)  100/10	•
104/14/75)  10	104/14/75]  10	
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\$5.000 \$5.21.43 26.02 25.39 19.06 31.05 31.010 32.39 30.39 1007.00 100 27.00 31.07 27.07 23.50 37.01 36.50 35.75	95.00	
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THOUSE	30.11					8.38	40.22	23+17		
POSER	28.6	32.75	31.29	21.59	34.44	9.4.6	38.80	32.06	72.47	
7 M C R M L	72.97					7.63	35.66	22.55		
RELIAN-Y	20.05					7 - 40	30.22	36.71		
SAFETT	27.00	50.75	2	23.05	,	37.21	20.00	36.62	70.00	
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	219818	RATING FOR SELECTION (BASED		EACH CONCEPT AFTER PASANETER RESENTIN ON SON NAK POINT	AFTER IGHTING POINTS	INCREASING FACTOR BY	Ť			6-5
	-	~		U N O U		•	-	-		
- 148444	27.00	31.67	20.07	23.50	37.01	34.54	30.05	35.75	70.05	
POSER	20.05	30.16	20.10	20.61-	34.25	34.46	35.46	32.00		
THERNAL	24-24				10.26	::	• •	2.3		
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	-5¢¢¢¢¢10#		(94/10/10)	<b>,</b>	GARRENT	T711 NEN-	MASHER!	"MASHER/ORYER. UI SPOSABLE TEGTHES"	SPOSAB	1072.33		SPACE STATIONS	(NO.)		
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		SELECTION (BASED	ED 0N 1	TAKANETER WEIGHT ON 100 S PAX POI	- Z	S FACTOR BY	<b>n</b>				
			,	z	CEPT						
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	74.66			34.52	40.04	9	6.7	\$ C	•		
VOLUME	39.09	-42.01-	-39,93-	_33.23	N (4	5 . 7		) (		والمساورة والمساورة والمساورة والمساورة والمساورة والمساورة والمساورة والمساورة والمساورة والمساورة والمساورة	
THERMAL	34.52	37.34	37,78	31.40	41.5		2.8	0.0	2.3		
RELIABOT	7	39,42	34.00	32.61	43.4	3.7	4.6	3 • 2	0.5		
MAINTENC SAFFTY	35,95	39.17	34.09	32.49	***		5.8	9.0		9	
	35.28	7.8	~	31.79		42095	42.26	43.52	60.53	or Or	•
REC-COST	1001	21.066	43:47	37.58	48.0	7.1	.0	1:	5.3	ST P	
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		•					1			PQ	•
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		RATING F		CONCEPT	¥	INCRE	27.5			B W	
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NORMAL	36.85	40.14	29.97	33.11	44.36	44.03	45.42	43.36	\$9.54		
BE J GHT	34.49	38.60	38.94	31.47	42.65	2 • 8	•		4		
POBER	39.41	39.55	39.38	35.79	5	3.7	5 . 2	<b>6</b> • 8	•		
VOLUME	34.56	36.07	40.02	32.98	42.27	2 : 7	5.5	3.7	2.6		
RELIAB-Y	37.53	40.04	00 • 1 •	33.63	9	֓֜֜֜֜֜֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֡֓֜֓֓֓֓֓֡֓֜֓֡֓֡֓֡֓֡֓֡֓֡֓֜֜֡֓֡֓֜֡֓֜		- u	, v		
MAINTENC	-37.80-	-41.15-	-06.04-	-33,75-	.2	3.6	5.0	2 . 7	8.7		
SAFETY	:	= ;	<b>3</b> (	32.67	ē.		4.0	3.1	8 • 5		
REC COST	•	35.51	35.33	27.91		39.71	49.1.	07.07	56.26		
1 1					٠	•		•	•		

APPLIANCE CONCEPT COMPONENT SUMMARY MATRIX

APPLIANCE FU.CTION: 3.3.3-GARMENT/LINEN/WASHING/DRYING COMBINATIONS

	NUMBER OF SAFETY CRITICAL	LIENS	2	2	0	<b>-</b>	∾.	2	0	٠.
		0				-				
	CANISTER DESICCANT	(B)	(	ı	,	1	1	1	1	8
	THERMAL STORAGE	8	1	-	1	ı	•1	1	!	•
	TRANSMISSION	0	-	<b>~</b>	•	1	-		ı	ı
N T S	BLOWER	(9)		-	_	-	<b>~</b>	н	-	-
ш 2	HEATER DC	9	-	(	,	~4			1	-
Δ Δ Σ	HEAT EXCHANGER	9	-		н		-		<b>~</b>	-
0	SWITCH SWITCH	6	10	10	01	21	,	ı	1	ı
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0	ELECTRIC SWITCH	9	7	7	7	7	4	4	4	4
ш Ж	FILTER	ම	-	-	-	-	<b>-</b>		H	-
ω Σ	WATER SEPARATOR	9		-	н	-	-		<b>~</b>	-
Z	<b>ACCUMULATOR</b>	<b>①</b>	~	Ν.	2	8	8	8	8	2
	SOLENOID VALVE	<u>ම</u>	7	8	8	7	8	8	8	2
	qMUq	0	2	8	7	8	-	, <del></del>	<b>~</b>	-
	<b>80</b> T0M	Θ	9	9	2	သ	m	က	7	2
	COMPONENT TYPE	APPLIANCE TYPE	FLUIDIC AGITATION/FORCED HOT AIR- ELECTRIC HEATER	FLUIDIC AGITATION/FORCED HOT AIR- THERMAL HEATER	FLUIDIC AGITATION/FORCED AIR DRYING RACK	FLUIDIC AGITATION/ELECTRICALLY HEATED DRYING RACK	WATER SPRAY AGITATION/FORCED HOT AIR-ELECTRIC HEATER	WATER SPRAY AGITATION/FORCED HOT AIR-THERMAL STORAGE HEATER	WATER SPRAY AGITATION/FORCED AIR DRYING RACK	WATER SPRAY AGITATION/ELECTRIC-

SPACECRAFT Space Station Garment/Linen

HABITABILITY SUBSYSTEM Housekeeping HABITABILITY FUNCTION Maintenance

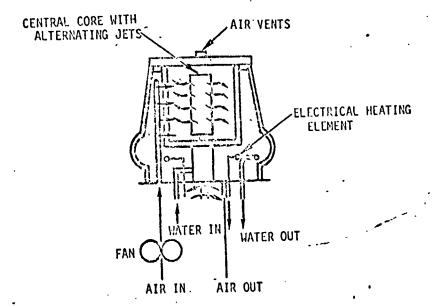
APPLIANCE FUNCTION Garment/Linen Washer/Dryer-Disposable Clothes

APPLIANCE CONCEPT NO./TITLE 1/Fluidic Agitation/Forced Hot Air-Electric Heat

INDEX NO. 3.3.3.1 REF. NO. 90

#### **DESCRIPTION**

This concept is a combination of clothes washer Concept 2 and clothes dryer Concept 1, as described previously in Section 3.3.1 and 3.3.2.



APPLIANCE CONCEPT REQUIREMENTS AND PENALTIES CALCULATIONS CONCEPT TOURIC AGITATION ADOCCED NOT ME ELECTRIC HEAT INDEX NUMBER (REF # 90P=125 51-54) ELECTRICAL POWER REQUIREMENTS POWER POWER (7) USE TIME DEHAND DEMAND (WATT-HR/ CYCLE) (1) X (7) (2) ③ (3) 6 (WATT-HR/ CYCLE) ①X③ CYCLE PEAK AVE RAGE PEAK AVERAGE COMPONENT (REF) (HR) (WATTS) (WATTS) (WATTS) (WATTS) VALVING 0. 55 0 Form 32 32 32 AGITATOR 150 FN 10 40 HEATER 227 277 708 727 MUNIXAM TOTAL MUMIXAM TOTAL THERMAL REQUIREMENTS LATENT SENSIBLE HEAT LEAK TO COOLANT SOURCE (BTU/HR) (BTU/HR) (ETU/HR) (BTU/HR) 0 0 4400 4.700 WATER HEAT LOSS 0 POMP 108 108 0 0 512 512 U DETTATUR MOTOR O 31 FAN 0 34 265 527 117 HELTER IWATER 675 1471 (5020) 221675) 77.6(265) 1471 (5020 TOTAL WATT (BTU/HR) WATT (BTU/HR) WATT (BTU/HR) WATT (BTU/HR) OPERATIONAL PENALTIES THERMAL
TO COOLANT
(BTU/HR/CYCLE) ELECTRICAL WEIGHT VOLUME HEAT LEAK SOURCE. (BTU/HR/CYCLE) (PK WATTS/CYCLE) (FT3/MISSION) (LB/MISSION) ALA

TOTAL

| MATTS/CYCLE | WATTS/CYCLE |
| (BTU/HR/CYCLE) | (BTU/HR/CYCLE) |

KG/MISSION (LB/MISSION)

M'/MISSION)

5/5

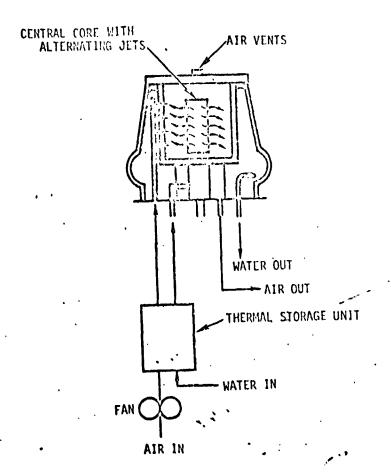
APPLIANCE CONSERT REQUIREMENTS AND PENALTIES CALCULATIONS (CONCLUDED) CONCEPT TO WILL AGIT TON FRANCED IN THE ELECTRIC HEAT INDEX NUMBER 5.3.3.1 FIXED WEIGHT/VOLUME REQUIREMENTS VOLUME (F(3) MEIGHT COMPONENT ·(REF) (LBS) PASIC WASILEL PUMP 2 ACCUMULATORS VALVING WATER SEPARATOR FACKAGING 18 MISCELLINEOUS (WASHEL 40 17.6 PASIC DRYER MISCELLINEOUS (URYER 10 TOTAL 167 (368) KG (LBS) M3 (FT3) <u> 5 0 L 1 D</u> M I/Y O L REQUIREMENTS WT/UNIT (REF)
(PKG.WT/UNIT)(REF)
(LB). (PKG. VOL/UNIT (REF) (PKG. VOL/UNIT) (PEF) (LB) (FT3) 0 UNITS/CYCLE(REF) TYPE .066 0016 DETENT 0019 GERNICIOE -066 TOTAL HT/CYCLE (LB) YOTAL VOLVEYELE TOTAL VOL 0,000 (0.7) GAS/LIQUID EXPENDABLES ANT . RECOVERED/CYCLE

① X ②

(LB) RECOVERY AMT. USED/CYCLE (REF) (LB) WASH WATER  $\Sigma$ .0495  $\Sigma$  0 58.2 (128.2) 18.2 . 110 TOTAL I DETYCYCLE (LB)

HABITABILITY SUBSYSTEM Housekeeping HABITABILITY FUNCTION Maintenance  APPLIANCE FUNCTION Garment/Linen-Washer/Dryer-Disposable Clothes	
ADDITION OF THE PROPERTY OF TH	
APPLIANCE CONCEPT NO./TITLE 2/Fluidic Agitation/Forced Hot Air-Inermal Storage	age
INDEX NO. 3.3.3.2 REF. NO. 90	

This concept is a combination of clothes washer Concept 2 and clothes dryer Concept 2 as described previously in Section 3.3.1 and 3.3.2.



CONCEPT FLUIDIC MAINTEN SERVED HOT AIR - THERMAL STORAGE

INDEX NUMBER 33.3.2

ELECTRICAL POWER REQUIR	Ē	ΕĦ	ENI	<u>. s</u>
-------------------------	---	----	-----	------------

	•	A (	C . POWE	R	0	C POWE	R
COMPONENT (REF)	USE TIME CYCLE (HR)	② PEAK (WATTS)	③ AVERAGE (WATTS)	(4) DEMAND (WATT-HR/ CYCLE) ① X ③	⑤ PEAK (WATTS)	© AVERAGE (WATTS)	(7) DEMAND (WATT-HK/ CYCLE) ① X ②
VALUING (WASHICK) FUMP AGITATOR MOTOR	<u>0</u> ·	55 32 150 31	32	32			
<u>FAN</u>							
		· /					
				•	***	•	Facility and a finished resources on
		MAXIMUM	•	TOTAL	MAXIMUTT		, TOTAL

## THERMAL REQUIREMENTS

SOURCE	LATENT (BTU/HR)	SENSIBLE (BTU/HR)	HEAT LEAK (BTU/HR)	TO COOLANT (BTU/HP)
WITTER HEAT LOSS (40°F)	<u> </u>	9400	1400	0
FUNIT	_ 0	108	108	7 0
MUTOR	•	512	512	0
FAIL	0	105	105	0
WATER TO ERMAL STORIKE	245	1053	198	1120
TOTAL	77. (265) NATT (BTU/HR)	1471(5020) - WATT (BTU/HR)	147! (5021) WATT (BTU/HR)	328 (1/20) MATT (BTU/HR)

# PERATIONAL PENALTIES

	•••	* 700	Durit :			•
1.	SOURCE	HEAT LEAK (BTU/HR/CYCLE)	TO COOLAIT (BTU/HR/CYCLE)	ELECTRICAL (PK WATTS/CYCLE)	WEIGHT (LB/MISSION)	VOLUME (FT <sup>3</sup> /MISSION)
<del></del>	N/A				•	
<del></del>						
•	101	AL WATTS/CYCLE	WAYTS/CYCLE		KG/MISSION	M3/MISSIGN

C2 - 584

APPLIANCE CONCEPT REQUIPEMENTS AND PENALTIES CALCULATIONS (CONCLUDED)

7/3

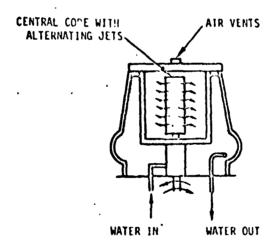
CONCEPT FLUIDE AGITATION/FORCED HOT AIR - TILERAIAL STORAGE INDEX NUMBER 3.3.3.2 (REF #40, p24, 25, 55.57) FIXED MEIGHIVVOLUME VOLUME (FT3) WEIGHT COMPONENT ·(REF) (IBS) 10 FASIC WASHER FUNIP 2 ACCUMPLETIORS VALVING WATER SIGRATOR ઙ૽ૺ FASKAGING 61 4.8 VISCELLANEOUS (U.ShEL BUFR THERIAL STORIGE UNIT MISCECCANTOUS (Dagre) 40 135 CLUTILES TOTAL 215 (47 1.61 KG (LBS) M3 (FT3) SOLID EXPENDABLE M I/Y O L REQUIREMENTS AT/CAČI E WT/UNIT (REF)
(PKG.WT/UNIT)(REF) VOL/UNIT (REF)
(PKG. VOL/UNIT) (REF) ①X② (LB) TYPE UNITS/CYCLE(REF) (FT3) (LB). .0016 DETECHENT GEKMICIDE YOUNG (FT3)  $\Sigma \mathfrak{I}$ .066 TOTAL WY/CYCLE (LB) .066 TOTAL VOL (6,620 (0.7) M<sup>3</sup> (.1<sup>3</sup>) 184 DAYS/MISSION X CYCLES/DAY GAS/LIQUID EXPERDABLES REQUIREMENTS . 0 AMT. RECOVERED/CYCLE

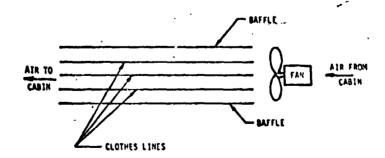
① x ②

(LB) AMT LOST/CYCLE 0 RECOVERY AMT.USED/CYCLE (REF) **FACTOR** TYPE WASH WATER .0495  $\Sigma$  $\Sigma$  0 TOTAL TOSY/CYCLE

SPACECRAFT Space Station	
HABITABILITY SUBSYSTEM Houseke	Garment/Linen eping HABITABILITY FUNCTION Maintenance
APPLIANCE FUNCTION Garment/L	inen-Washer/Dryer-Disposable Clothes
APPLIANCE CONCEPT NO./TITLE_3	/Fluidic Agitation/Clothesline-Forced Convection
INDEX NO. 3.3.3.3	REF. NO. 90

This concept is a combination of clothes washer Concept 2 and clothes dryer Concept 8 as described previously in Section 3.3.1 and 3.3.2.





5/3

APPLIANCE CONCEPT REQUIREMENTS AND PENALTIES CALCULATIONS INDEX NUMBER 3.3.3.3 CONCEPT FEMUL AGITATION / CLOTHES LINE - FORCED CONVECTION (Ker# 90 p. 24, 25, 72, 73) ELECTRICAL POWER REQUIREMENTS POWER POWER DEMA'ID USE TIME DEM/AND **②** ③ (3) 6 (WATT-HR/ (WATT-HR/ CYCLE PEAK AVERAGE PEAK AVERAGE ()x() () x () COMPONENT (REF) (HR (WATTS) (WATTS) (WATTS) (WATTS) VACUING (WASI'SR) 0. 55 32 ZZ FUNIP 32 AGITATOR 150 150 MoroR 150 FAN 237 MAXIMUM TOTAL MAXIMUM TOTAL THERMAL REQUIREMENTS LATENT SENSIBLE HEAT LEAK TO COOLANT SOURCE (BTU/HR) (BTU/HR) (BTU/HR) (BTU/HR) WATER HEAT LOSS (40°F) 4400 4900 0 108 108 PUMP 0 512 AGITATO2 512 0 FARI 24 24 133 WATER 133 19,0 (133) 11:71 (5020) 1471**(5020)** 0 TOTAL WATT (BTU/HR) WATT (BTU/HR) WATT (BTU/HR) WATT (BTU/HR) OPERATIONAL " PENALTIES ELECTRICAL **WEIGHT** VOLUME HEAT LEAK TO COOLANT SOURCE . (PK WATTS/CYCLE) (FT3/MISSION) (STU/HR/CYCLE) (BTU/HR/CYCLE) (LB/MISSION)

WATTS/CYCLE

(BTU/HR/CYCLE)

KG/HISSION

(LB/MISSION)

MY/HISSION

(IT)/HISSION)

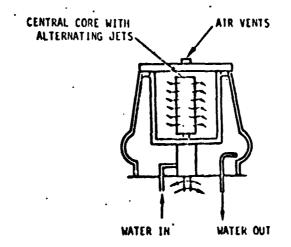
TOTAL

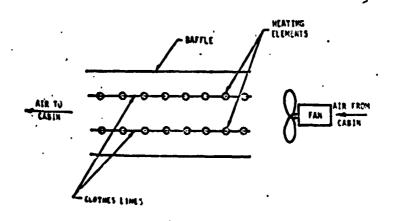
WAYTS/CYCLE (BTU/HR/CYCLE)

CONCEPT/201116 1 31TATIO	N/2011	TING	NTS AND PENALTIES OF	CALCULATIONS (I	CONCLUPED)  1NDEX NUMBER	R 237.3
(REF #90, 124, Z	5, 72, 72)					
<u>f</u> .	TXED W	EISHIV	<u> LOLUME</u> RE	EQUIREM	ENTS	
COMPONENT	·(REF)		WEIGHT (LBS)		,	VOLUME (FT3)
FUMP MASHER		`	70		********	10
2 ACCUMULATORS			-10		<del></del>	3.6
VALKING			()			18:
WATER SERRATUR			3	<del>/_ 1.02</del> )		
PACKIGHILLE MISC (UNSHER)		•	<u> </u>	<u> [193]</u>	<del></del>	4.0
DUIT.			25			150
47N			25 3	T(2:13)	,	
CLUTIVES			135 ,	<del></del>	<del></del>	25.6
	TOTAL	. '[	259 (. KG (LBS)	571)	4.2	(/13.9)-
•.					•	
<u> </u>	D EXP	ENDABL			EMENIS	<u></u>
	0	(2) WT/UNIT (I (PKG.WT/UNIT	(3 REF) WT/CY	CLE VI	(A) DL/UNIT (REF) DL/UNIT (REF)	VOL/CYCLE
	CYCLE(REF)	(LB)	(LE		G. VOL/UNIT) (PEF) (FT3)	
DETERGENT!		053 	<u></u>		.0016 (.021:1)	.0019
GERMICIOS	<del></del>					
	· · · · · · · · · · · · · · · · · · ·		******			
	-					
			DOTAL WI	/CYCLE	. Σ@	TOTAL VOL/CYCLE  (F13)
TOTAL NT. 2 THISSION CYCLES/DAY		74 S/MISSTON	x <u>066</u>	•	11.0	) (24.3)   KG (L8)
	· ·	o,	(LB)	, <b></b>		NO (10)
MISSION Z	x 18	1 <b>∳</b> \$/H15510N	x .0019	•	0.0	0 (0.7)
CYCLES/DAY	DAY	S/MISSION	101.VOL/CY (FT3)	ici E		N2.(1,12)
			•	•		•
G A S	<u>/LIQUID</u>	EXPE	NDABLES	REQUIRE	MENTS	
,	_		· <b>②</b>		0	•
	T.USED/C1		- RECOVERY	AMT . RECO	VERED/CYCLE	AMT LOST/CYCLE  (D-(3)
TYPE	' (LB	)	FACTOR	W	(LB)	_(LB)_
RUSE WATER		55	1.0000			.0495
The second		<u>.</u>	7,000			
		·			<del></del> ,	
		//0				OPEC
ΣΦ		110	•		ΣΦ.	.0495
TOTAL NT Z	,01	•	سدن بر دس	10 7	1/2 - 1	E.C. C. (124m)
THISSION EVELETORY	a Tavs/Hiss	for X	0475 1 1.031/CVC17	18.2.	110	KG (LE)
	,	-	œ (3)	(LD)	<b>t (</b> )	• •

SPACECRAFT	Space Sta	ation			
HABITABILI	TY SUBSYSTEM_	Housekeeping	_HABITABILITY	FUNCTION	Garment/Linen Maintenance
APPLIANCE	FUNCTION Garm	ment/Linen-Washe	- r/Dryer-Dispos	able Clot	nes
		ITLE <u>4/Fluidic A</u>			
	3.3.3.4			wit	n Electric Heat
1110E/ 110	3.0.0.1	·			

This concept is a combination of clothes washer Concept 2 and clothes dryer Concept 9 as described previously in Section 3.3.1 and 3.3.2.





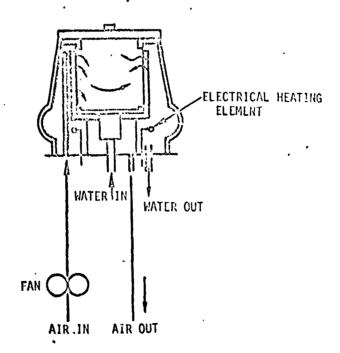
	0	A		<b>A</b>	D		(7)
•	USE TIME	. ② PEAK	(3) Average	DEMÂND (WATT-HR/ CYCLE)	(5) PEAK	<b>6</b> Average	DEMAND (WATT-HE CYCLE)
COMPONENT (REF)	(HR)	(WATTS) 55	(WATTS)	①×③	(WATTS)	(WA1 'S)	<b>O</b> x()
MOCVING . PUNIP		32	.32	_32			
FAN	-4	150	150	150	<del></del>		•
HEATER	4				256		
•		<del></del>	<del></del>		•	•	<del></del>
		237			256		
		MAXIMUM	•	TOTAL	MAXIHUM		. TOTAL
•							•
		•					
	•		•				•
		I HERMAL'	REQUI	REMERIS			•
Source		LATENT	SEN	SIBLE	HEAT LEAK (BTU/HR)		COOLANT
_	055(25E)	LATENT (BTU/HR)	SEN (BTI	SIBLE U/HR)	(BTU/HR)		BTU/HR)
_	<u>(5(56</u> 7)	LATENT	SEN (BTI	SIBLE U/HR)			
WATER HEAT CO		LATENT (BTU/HR)	SEN' (BTI	SIBLE U/HR)	(BTU/HR) 4400		BTU/HR)
WATER_HEAT CO PUMP HOLTATOR MOT FAN	·	LATENT (8TU/HR)	SEN! (BTI	51BLE 10/HR) 10/B 10/B 10	(BTU/HR)  4400 108 512 10		BTU/HR)
WATER_HEAT CO PUMP HISTATOR MOT FAN HEATER/WATER	·	LATENT (BTU/HR)  6 0 0 265	SEN' (BTI	1818LE 19/HR) 188 188	(BTU/HR)  4400  108  512		BTU/HR)
WATER_HEAT CO PUMP HOLTATOR MOT FAN	·	LATENT (8TU/HR)	SEN' (BTI	51BLE 10/HR) 10/B 10/B 10	(BTU/HR)  4400 108 512 10		BTU/HR)
WATER_HEAT CO PUMP HISTATOR MOT FAN HEATER/WATER	UR.	LATENT (BTU/HR)  6 0 0 265	SEN: (BTI	10 10 10 10 10 10	(BTU/HR)  4400 108 512 10 873	o) -	BTU/HR)  ()  ()  ()  ()  ()
WATER_HEAT CO PUMP HISTATOR MOT FAN HEATER/WATER	UR.	LATENT (8TU/HR)  6  0  0  265  77.6 (265)	SEN: (BTI	(5020)	(BTU/HR)  4400 108 512 10 873	o) -	BTU/HR)  0  0  0  0  0  0  0 (0)
WATER_ HEAT CO PUMP HEITATOR MOT FAN HEATER/WATER	UR.	LATENT (8TU/HR)  6  0  0  265  77.6 (265)	SEN: (BTI	(5020)	(BTU/HR)  4400 108 512 10 873	o) -	BTU/HR)  0  0  0  0  0  0  0 (0)
WATER_ HEAT CO PUMP HEITATOR MOT FAN HEATER / WATER	UR.	LATENT (8TU/HR)  6  0  0  265  77.6 (265)	SEN: (BTI	(5020)	(BTU/HR)  4400 108 512 10 873	o) -	BTU/HR)  0  0  0  0  0  0  0 (0)
WATER_HEAT CO PUMP HISTATOR MOT FAN HEATER/WATER	UR.	LATENT (8TU/HR)  6  0  0  265  77.6 (265)	SEN: (BTI)	(5020)	(BTU/HR)  4400 108 512 10 873 1171 (502 MATT (BTU/HR)	o) -	BTU/HR)  0  0  0  0  0  0  0 (0)
WATER HEAT CO PUMP HGITATOR MIST FAN HEATER / WATER	TOTAL	LATENT (8TU/HR)  0  0  265  77.6 (265)  MA1. (8TU/HR)  THERMAL	SEN! (BT!  4  14/1  MATT (	SIBLE U/HR) (400 (CB   ) (10   ) (5020) (5020) (BTU/HR)	(BTU/HR)  4400 108 512 10 873 1171 (502 MATT (BTU/HR)	O) WAT	BTU/HR)  Q Q Q O (C) T (BTU/HR)
WATER_HEAT CO PUMP HISTATOR MOT FAN HEATER/WATER	TOTAL	LATENT (BTU/HR)  O  O  265  77.6 (265)  MA1. (BTU/HR)  THERMAL AT LEAK	SEN: (BTI)	(5020)	(BTU/HR)  4400 108 572 10 873 1171 (502 MATT (BTU/HR)	O) WAT	BTU/HR)  0  0  0  0  0  0  0 (0)
WATER HEAT LO PUMP HGITATOR MOT FAN HEATER/WATER	TOTAL	LATENT (BTU/HR)  O  O  265  77.6 (265)  MA1. (BTU/HR)  THERMAL AT LEAK	SEN: (BT)  A  III / 1  WATT (	SIBLE U/HR)  (400  (CB   )  (12   )  (5020)  (5020)  (BTU/HR)  HALILES  ELECTRICAL	(BTU/HR)  4400 108 572 10 873 1/171 (502 MATT (BTU/HR)	O) WAT	BTU/HR)  O  O  O  O  (O)  T (BTU/HR)
WATER HEAT LO PUMP HGITATOR MOT FAN HEATER / WATER	TOTAL	LATENT (BTU/HR)  O  O  265  77.6 (265)  MA1. (BTU/HR)  THERMAL AT LEAK	SEN: (BT)  A  III / 1  WATT (	SIBLE U/HR)  (400  (CB   )  (12   )  (5020)  (5020)  (BTU/HR)  HALILES  ELECTRICAL	(BTU/HR)  4400 108 572 10 873 1/171 (502 MATT (BTU/HR)	O) WAT	BTU/HR)  O  O  O  O  (O)  T (BTU/HR)
WATER HEAT LO PUMP HGITATOR MOT FAN HEATER / WATER	TOTAL	LATENT (BTU/HR)  O  O  265  77.6 (265)  MA1. (BTU/HR)  THERMAL AT LEAK	SEN: (BT)  A  III / 1  WATT (	SIBLE U/HR)  (400  (CB   )  (12   )  (5020)  (5020)  (BTU/HR)  HALILES  ELECTRICAL	(BTU/HR)  4400 108 572 10 873 1/171 (502 MATT (BTU/HR)	O) WAT	BTU/HR)  O  O  O  O  (O)  T (BTU/HR)

7

5/5

SPACECRAFT Sp	ace Station						
HABITABILITY SUB	SYSTEM <u>Housek</u>	ceping	HABIT	ABILITY	FUNCTION_	Garment/Linen Maintenance	
APPLIANCE FUNCTI	ON <u>Garment/L</u>	inen-Was	her/Drye	r-Dispos	able Clot	hes	_
APPLIANCE CONCEP	T NO./TITLE	5/Water	Spray Ag	<u>itation</u>	/Force Hot	Air-Electric He	201
INDEX NO. 3.	3.3.5	<del></del>	REF.	NO	90		
DESCRIPTION							

This concept is a combination of clothes washer Concept 7 and clothes dryer Concept 1, as described previously in Section 3.3.1 and 3.3.2.



5%

		ELECI	•	<u>POWER</u> C. POWE	REQUIRE R	<u>M E N T S</u> D :	C POWE	2
COMPONENT VALVES	(REF)	USF TIME CYCLE (HR) O .	2) PEAK (WATTS) 55)	③ AVERAGE (WATTS)	DEMAND (WATT-HR/ CYCLE) ① X ③	⑤ PEAK (MATTS)	(6) AVERAGE (WATTS)	(7) DEMAYE CYCLE) ① X (/)
YMP 1617ATOR I FRII YEATER	MTCR.	5 4 4	32 150 10			227		
	and The articles		237 MAXINUM		TOTAL	227 MAXIMUM		, TOTAL
٠,		. •	<u> </u>	REOUT	<u>.</u> R <u>ements</u>			<b>,</b>
SOUR	CE	•	LATENT (BTU/HR)	SEN	SIBLE J/HR)	HEAT LEAK (BTU/HR)		COOLANT
WATER HE FUN:P M-OR FANI	797 <b>L</b> OSS	(40°F)	0 · 0 0		100 108 112 34	4400 108 512 34	}	0 0
	WATER		265 7. (265) MATT (BTU/HR)	1 <u>4.71</u> 1	527 (5026) -	1/7 1471 (502 WATT (BTU/HR)	(0) - 19	675 (67 (BTU/HR)
	•							
SOU	· ·		PERATION THERMAL	NAL PE  O COOLANT U/HR/CYCLE)	NALIIES  ELECTRICAL (PK WATTS/CYC	WEIGH CLE) (LB/MISS		OLUME /M15510N)
300	N/A	(BIO/IIK)		• .		(LD/Fi133		,,,,,,,,

C2-593

WATIS/CYCLE (LTU/HR/CYCLE) KG/MISSION (LD/MISSION)

M'/MISSION (FT'/MISSION)

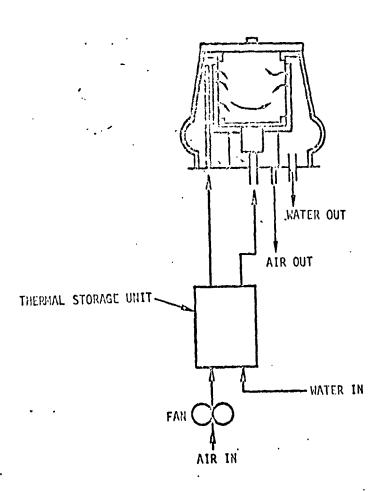
WATTS/CYCLE (BTU/HR/CYCLE)

TOTAL

APPLIANCE CONCEPT REQUIPEMENTS AND PENALTIES CALCULATIONS (CONCLUDED) Storing REMATION/FORCED HOT AIR ELECTRIC HELT INDEX NUMBER 3.2.3.5 (REF #90- P 36,31, 51-17) FIXED WEIGHT/VOLUME REQUIREMENTS VOLUME (FT3) WEIGHT COMPONENT (REF) (LBS) Paric WASHER 10.5 3.6 ACCUATOR 10 VACVING 17.1 3 4415K SECTE MCEAGING 67 MISC CONSTHE 40 17.6 40 CACTRIS 155 25.6 TOTAL 1'7/1 (375) KG (LBS) M3 (FT3) · EXPENDABLE M IVY O L REQUIREMENTS WI/CYCLE WT/UNIT (REF)
(PKG.WT/UNIT)(REF) VOL/UNIT (REF) VOL/CYCLE 0 (PKG.VOL/UNIT)(REF) (FT3) ①x② (LB) (F13) UNITS/CYCLE (RE!) TYPE (LB) Direct Tot/ .0016 0019 GERANCIDE OCA TOTAL WIZCYCLE (LB)  $\Sigma$  $_{3}$  $\Sigma$  (§ TOTAL VOLVEYCLE TOTAL WT. .066 CYCLES/DAY DAYS/MISSION TOT.WIZCYCLE (LB) TOTAL VOL ... 2 .0019 CYCLES/DAY DAYS/MISSION GAS/LIQUID EXPENDABLES REQUIREMENTS 0 ANT . RECOVERED/CYCLE AMT LOST/CYCLE 0 RECOVERY AMT. USED/CYCLE (REF) FACTOR TYPE 0475 WATER 9991 .0.415 110  $\Sigma$  (4)  $\Sigma$  (1) (Z. (A) (LB) (Z (1)

SPACECRAFT	Space Station		
	TY SUBSYSTEM House		Garment/Linen FUNCTION <u>Maintenance</u>
APPLIANCE F	FUNCTION Garment/L	<u>inen-Washer/Dryer-Dispos</u>	able Clothes
APPLIANCE (	CONCEPT NO./TITLE_	6/Water Spray Agitation	/ <u>Forced Hot Air-Thermal Sto</u> rage
INDEX NO	3.3.3.6	REF. NO.	90
DESCRIPTION	<b>,</b>		

This concept is a combination of clothes washer Concept 7 and clothes dryer Concept 2 as described previously in Section 3.3.1 and 3.3.2.



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APPLIANCE CONCEPT REQUIREMENTS AND PENALTIES CALCUI ATTOMS CONCEPT WITTER SPRAG AGITATION / FORCED FOR AIR THERAINE STURAGE INDEX NUMBER 3.3.3,6 P36 37 55-57) ELECTRICAL REQUIREMENTS POWER USE TIME (4) DEMAND (WATT-HR/ DEMAND (2) (3) (5) 6 (WATT-HK/ CYCLE AVERAGE PEAK PEAK AVERAGE CYCLE)
(DX(3) CYCLE) COMPONENT (WATTS) (REF) (HR) (WATTS) (WATTS) (WATTS) 55 VALVES 0. 150 237 MAX1MUM TOTAL MAXIMUM TOTAL THERMAL REQUIREMENTS LATENT SENSIBLE HEAT LEAK TO COOLANT SOURCE (BTU/HR) (BTU/HR) (BTU/HR) (BTU/HP) WATER HEAT LOSS (40F) 4400 0 1400 PURIE 108 108 0 MOTOR\_CAREITETE 0 512 0 512 O 105 105 FAN 0 1120 THERMING FORAGE 265 198 1053 324 (1120) 14-11 (5020) 77.6 (265) 14:11 (5020) TOTAL WATT (BTU/HR) WATT (BTU/HR) WATT (BTU/HR) WATT (BTU/HP) OPERATIONAL . PENALTIES **ELECTRICAL WEIGHT** VOLUME HEAT LEAK TO COOLANT (BTU/HR/CYCLE) SOURCE (BTU/HR/CYCLE) (PK WATTS/CYCLE) (LB/MISSION) (FT3/MISSION)

C2-596

WATTS/CYCLE

(BTU/HR/CYCLE)

(EL)/HI2210A) H3/HI2210A

AG/MISSION

(LB/MISSION)

KATTS/CYCLE (BTU/HR/CYCLE)

TOTAL

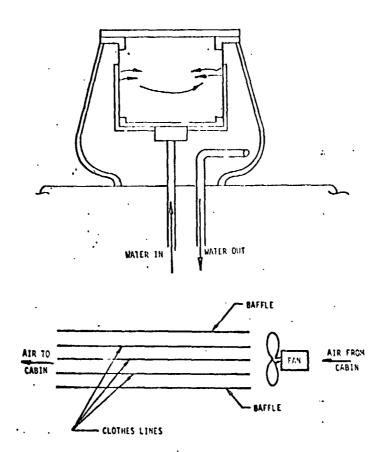
53

APPLIANCE CONCEPT REQUIREMENTS AND PENALTIES CALCULATIONS, (CONCLUDED) CONCEPT LATTE TERRY PROPERTY AT FERCE HOT AIR-THERAIMS STORPEE INDEX NUMBER 33.3.6 490 P'=6=7 55-57) FIXED WEIGHT/VOLUME REQUIREMENTS VOLUME (FT3) WEIGHT COMPONENT (REF) (LBS) POEIC WASH'S 10.5  $\mathcal{BC}$ RIMIN ACCUMILLY TUES 40 YMIVING WATER SEEMERTUR PACKAGING 6.7 MISCIWATHER. THERRIVE STORAGE UNIT 105 MISC (C'UCS) 40 CLOTIES 135 TOTAL 215 480) 1.58 KG (LBS) M3 (FT3) 50L1D WI/YOL EXPENDABLE REQUIREMENTS (rB) VOL/UNIT (REF) (PKG.VOL/UNIT)(REF) (FT<sup>3</sup>) VOI /CYCLE WT/UNIT (REF) 0 (PKG. NT/UNIT) (REF) (F13) UNITS/CYCLE(REF) (LB) .0016 ATTE GENT! 10019 066 (2017) GERICIOS TOTAL KT/CYCLE TOTAL VULLEYELE  $\Sigma$ 3  $\Sigma$   ${f \odot}$ TOTAL WT. 11.0 KG (LB) 1066 DAYS/HISSION CYCLES/DAY TOTAL VOL (1000 (0.7) .0019 MISSION TOT. VOL /CYCLE CYCLES/DAY DAYSIMISSION GAS/LIQUID REQUIREMENTS EXPENDABLES AMT LOST, CYCLE

(LB) 0 AMT.RECOVERED/CYCLE RECOVERY AMT. USED/CYCLE (REF) **FACTOR** · (Lb) WASH WATER 110 .0495  $\Sigma \odot$  $\Sigma$   $_{0}$  . 184 58.2 (124.2) CYCLE/DAY -TOTAL TOST/LYCLE DAYS/MISSION (18) (z (1)

SPACECRAFT Space Station	
HABITABILITY SUBSYSTEM Housekeeping HA	Garment/Linen ABITABI'ITY FUNCTION <u>Maintenance</u>
APPLIANCE FUNCTION Garment/Linen-Washer/	Oryer-Disposable Clothes
APPLIANCE CONCEPT NO./TITLE 7/Water Spray	Acitation/Clothesline-Forced Convection
INDEX NO. 3.3.3.7	REF. NO. 90
DESCRIPTION	

This concept is a combination of clothes washer Concept 7 and clothes dryer Concept 8 as described previously in Section 3.3.1 and 3.3.2.



CONCEPTED PORT FLAG	APPLIANCE STORY	E CONCEPT REC /Canthies	OTREMENTS AND LINE-FOX	PLNALTIES CALCI	HATIONS CT/CA/ INDEX	NUMBER 2	2.3.7
(KEF #90 P2	6,27,72,	72.)					
	<u>ELECT</u>		POWER	REQUIRE			•
	USE TIME CYCLE	② PEAK	C POWE  (3)  AVERAGE	(4) DEMAND (WATT-HR/	(5) PEAK	C POWE	(7) DEMAND (WATT-HR
COMPONENT (REF)	(HR)	(WATTS)	(WATTS)	(Dx(3)	(WATTS)	(WATTS)	<b>CY</b> (11) (1) x (7)
VICVES	<del>0</del> .	-57	!			<del></del>	
AGINT C. MOTOS		150 - -7.					·
			Mark or 2014 (1-1-5)				
	<del></del>	927	•	-		•	**************************************
		237.	•	TOTAL	MAXIMUM	•	. TOTAL
•	•						•
			•		,		•
	т	HERMAL		REMENTS		•	
	-		HENEL	rents			
SOURCE		(BTU/HR)		SIBLE J/HR)	HEAT LEAK (BTU/HR)		COOLANT STU/HP)
GOTER KETT LOS	(4%) _	0	<u>-4</u>	100	4400	<u> </u>	
FU; P		0		04 7	100	7	
Mirie (ASITE)	<u>&lt;)</u> _	<u> </u>		<u> </u>	512		
FIN		0		4	24		
MACCE		188			133	-	
	TOTAL 2	9.9 (133	) 14216	502.0) -	1471(5020	g)	_0
•	•	IATT (BTU/HR)	WATT (	BTU/HR)	WATT (BTU/HR	) WATT	(BTU/HR)
•		•		•			
•				•		•	
		•	•		••		
	0 !	<u> </u>	NAL PE	<u>NALTIES</u>			
r	HEAT L		TO COOLANT	ELECTRICAL	WEIGH		OLUME
SOURCE	(BTU/HR/C	YCLE) (B	TU/HR/CYCLE)	(PK WATTS/CYC	LE) (LB/MISS •	10N) (FT	/MISSION)
N/A		· · ·	• •		·		
		<del></del> -					
<del>;</del>	<del></del>		<del></del>		·	· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·
-							
. 10	TAL MÄTTS/ (BTU/HR	CYCLE) (	WATTS/CYCLE BTU/HR/LYCLE)		AG,'M155 [!B/R155	ION M <sup>3</sup> /	MISSION)

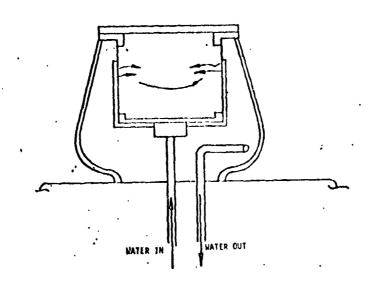
.C2-599

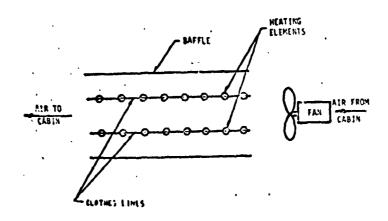
CONCEPT WITE STRAY 1191	MITIUN/2	NPEMBAS AND PENALTIES CA LOTICES LINE-FORCES	acula lons (concluded) Described index	NUMBER 33.3.7
(REF 1440 F 76,	37,72,7	<i>5)</i>		
<u> </u>	D WEIG	H T/Y O L U M E R E	QUIREMENIS	
COMPONENT	/ncc\	WEIGHT (LBS)		VOLUME (FT³)
· MASIC WASHELL	(REF)	(۱۵۵) بر بسط	~)	10,5
Peril		4	<del></del>	
2 HOLUN'IKATORS		46		2,6
VACVING		6	7200	
WATER SCHOOL		3		
MISC (WASILE!)			<i>2</i>	<u> </u>
Fill	<del></del>	25		
Za Ce En		25		130
CLOTTES				25,6
	TOTAL	1511	= -	11:01 (17:01)
	TUTAL .	171 (185)		4.91 (17%)
•		(255)		
<u>\$ Q L 1 D</u>	EXPEND		REQUIREMENT	_
0	WT/U	O O	LE VOL/UNIT (F	EE) AOT/CÁCTE
TYPE UNITS/CYCLE	(PKG.4 (REF)	rt/UNIT)(REF) ①x② (LB) (LB)	(PKG.VOL/UNIT	)(PEF) (Dx(4) (FT <sup>3</sup> )
DETERMENT !		0055 066	,0016	.0019
GERANCIDE"	(·	<u>CS ( )</u>	7.6019	/
t.				
				ngan aktib ga dan di kera ( agadi didaktib kila di pana). Ngan visan
		<b>S</b> 0	<del></del>	50 0010
		∑3 _066	CYCLE	YUTAL VOLZEYELE
TOTAL LIT	_	(re)		(FT <sup>3</sup> )
TOTAL WT. Z	184	x_ •065		11.0 (Z-: =)
CYCLES/DAY	DAYS/MISS	10% TOT. WT/( . E (LB)	L	KG (LB)
TOTAL VOL . Z x	141	x .0019	• [	0.000.000
CYCLES/DAY X	DAYS/MISS	ION YOT. VOL/CYC		0.070 (0.7)
`		(FT <sup>3</sup> )		
			•	• •
<u>G A 5/L 1</u>	QUID E	<u>XPENDABLES</u>	<u>EQUIREMENTS</u>	
	Φ	. 🕖	MT . RECOVERED/CYCL	•
. AHT	.USED/CYCLE (RE	F) RECOVERY	OxO	E AMT LOST/CYCLE ①-③
WASH WATEL	/ (LB)	FACTOR - 449	(LB)	(18) - C475
KINSE USTER	· <u>55</u>	1.0000	· · · · · · · · · · · · · · · · · · ·	<u> </u>
		•		
	110	<del></del>		A 101 =
Σ0	110	nicifique	$\Sigma$	· <u>-0-195</u>
TOTAL UT		•	,	
TOTAL NT. 2	124		18.2. 1/0	• 58.2 (128.2)
CYCLT70AY D	AVS/HISSION -	TOTAL LUST/CYCLE	(14) F. A	KG (LB)

SPACECRAFT	Space Station		•
HABITABILI	TY SUBSYSTEM Hou	sekeeping HABITABILITY FUNCTION	Gamment/Linen Maintenance
APPLIANCE	FUNCTION Garment/L	inen-Washer/Dryer-Disposable Clothe	es
APPLIANCE	CONCEPT NO./TITLE	8/Water Spray Agitation/Clotheslin	ne-Forced Convection
INDEX NO	3.3.3.8	REF. NO. 90	with Electric Heat

# DESCRIPTION

This concept is a combination of clothes washer Concept 7 and clothes dryer Concept 9 as described previously in Section 3.3.1 and 3.3.2.





CONCEPT. VATER STRAY	APPLIA ASITATION	NCE CONCEPT V /240746	REQUIPEMENTS AND	PENALTIES CALC	BLATIONS	NUMBER 7	7.3.8
(RE- 490, P 30	57,74,7	5)	WITH	GLECTRIC H	EAT		
• , ,		IRICAL	POWER	REQUIRI	MENIS		
			AC . POHE	R	D (	POWE	
	USE TIME	(2)	. ③	DEMAND	(3)	<b>6</b>	(7)
4	CYCLE	PEAK	AVERAGE	(WATT-HR/ CYCLE)	PEAK	AVERAGE	(WATT-HI
COMPONENT (REF)	(HR)	(WATTS) سرس	(NATTS) -7	(1) x (3)	(ATTS)	(WATTS)	(i) x (i)
PURLY	<u> </u>	<u>55</u>			•		
AGITUES AUTOR	<del>/</del>	150	150	150			
FAN	4	3					
HEATER	<u>+</u>				25%		
			_				
	<del></del>		-		•		
	*******	1	-		*********	•	
		231	٠ .	*****	256	•	
,		MAXIMUM		TOTAL	MUMIXAN		. TOTAL
							•
	•						
				•			
		I H E R M A	L' REQUI	REMENTS			
•		4.445117	***		11 <b>5</b> 40 4 5 4 4	••	****
SOURCE		LATENȚ (BTU/HR)		ISIBLE U/HR)	HEAT LEAK (BTU/HR)		COOLANT BTU/HR)
	- 1		•			`	
WATER HEAT LUSS	(10F)		<u> </u>	100	4400		
PUMP				107 (1	108	.( ]	-
MUTOR (AGITATO	<u> (2)                                    </u>			5/2	512	]	
FAN		0		10			
HEATER WATER	<del></del>	265		608	873		
1				•		\	
	JATOT	77.6 (24		(5020) -	1471 (502		<i>V</i>
		WATT (BTU/	HR) WATT	(BTU/HR)	WATT (BTU/HR)	MAT	(BTU/HP)
4		•		•			
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•				•			
	9	PERAT.	<u>lonal · Pe</u>	NALTIES	,		
		THEP	MAL				
/ Source	HEAT (BTU/HR	T LEAK	TO COOLANT (BTU/HR/CYCLE)	ELECTRICAL (PK WATTS/CY)	WEIGHT (LB/MISS) (LB/		<b>VOL</b> UME P/MISSION)
JOUNCE /	(BIU/IIK	/C10EE/	(BIO) MAY ETCEE)	(rk mail sych	•	10.17	71113310117
N/A			• ,	•			
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· 1	OTAL		145 94 44 - 44	**********	September 1 a		
	W411 (81U/	S/CYCLE HR/CYCLE)	WATTS/LYCLE (BTU/HR/CYCLE)		KG/H1551 (LB/H1551	ON) (FT	MISSION (MISSION)

F 1	XED WEL	CHINA OF FW	E REQU	J R E M E N T S	
		W	EIGHT	, , , , , , , , , , , , , , , , , , ,	VOLUME
OMPONENT CONTRACTOR	(REF)	$\varepsilon$	(LBS)		(iii) 10.5
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CLOTHES			75		25,6
	TOTAL	1-	70 (279	5]	5.19 (140
	•		(LBS)	4.)	M <sup>3</sup> (FT <sup>3</sup> )
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<u> 5011</u>	D EXPEN	DABLE MI		QUIREMENTS	,
	O /exc	/UNIT (REF)	MINCACI E	VOL/UNIT (REF)	AOF/CACLE
	YCLE(REF)	.WT/UNIT)(REF) (LB)	①x (?)	(PKG. VOL/UNIT)(RE (FT3)	F) (FT-1)
TELGENT /	·	055	.066	0015	-0019
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		Σ①	OG G	Σ	5 .0019
			TOTAL WT/CYCL	Ε —	D TOTAL VOLLEYCLE
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ilssion • Z			OT.WI/CYCLE	- <del>L</del>	KG (LB)
otal wt. HISSION Z CYCLES/DAY	DAYS/HI	33101			
CYCLES/DAY	·		_		
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CYCLES/DAY	·	¥ • (	_	•	(O. 7)
CYCLES/DAY OF 1 YOU	184	¥ • (	0019	•	() ( (0.7) W (H)
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CYCLES/DAY  OT: VOL  MISSION Z  CYCLES/DAY  E A S/L  TYPE  W45H WATER	X DKIS/MIT  LIQUID  AMT.USED/CYCLE(IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII	EXPENDABL  REF) RECC	OO/G  OT. YOU/CYCLE  (F12)  E.S. R.E.Q.  OVERY  CTCR  / 74/	UIREMENIS (3)	AMT LOST/CYCLE

# D2-1185G1-5

SPACECRAFT	T Space Station	Sin ik sage. Na san sadbadbar dar Anne Anadonski	Garment/
HABITABIL:	ITY SUBSYSTEM Housek	eeping HABITABILITY	FUNCTION Linen Maintenance
APPL IANCE	FUNCTION Garment/	Linen Washer/Dryer - Dis	posable Clothes
APPLIANCE	CONCEPT NO./TITLE_	9/Disposable Clothes	
INDEX NO.	3.3.3.9	REF. NO.	

DESCRIPTION: This concept assumes no clothes washer/dryer will be used, and soiled clothing will simply be disposed of and replaced by new ones. An average wear rate of .484 kg (1.066 lb) clothing/towels/washcloths per man per day was assumed from Reference 245. A packaging weight factor of 1.3 was used from Reference 100. Bulk density of the clothes, including packaging, was assumed to be 0.0119 cu m/kg (0.190 cu ft/lb) as recommended in Reference 100.

	EFECT	<u>r r i c a l</u>	POWER	BEdifbe	MENIS	
omponent (ref)	USF TIME CYCLE (HR)	Q PEAK (WATTS)	C POWE  AVERAGE (WATTS)	R (4) DEMAND (WATT-HR/ CYCLE) (1) X (3)	D C  S  PEAK (NATTS)	(7) (6) DEMAN AVERAGE (WATT-H CYCLE)
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	·	MAXIMUM		TOTAL	MAX EMUM	TOTAL
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	TOTAL	WATT (BTU/HR)	WATT (	BTU/HR)	WATT (BTU/HR)	WATT (BTU/HR)
			•			
	<u>0</u>	PERALLO	<u>nal ze</u>	BALIIZS		
SOURCE A'/A	HEAT (BTU/HR/		O COOLANT U/HR/CYCLE)	ELECTRICAL (PK WATTS/CYC	MEIGHT	VOLUME (FT*/M15S1ON)
	<u></u>		****			

C2-605

APPLIANCE CONCEPT REQUIREMENTS AND PENALTIES CALCULATIONS (CONCLUDED) INDEX NUMBER 37. 2. 9 CONCEPT PIST STATE CLOTTES EIXED WEIGHT/VOLUME WEIGHT (LBS) VOLUME (FT3) COT TONENT ·(REF) CLUTHES 529 TOTAL M3 (FT3) KG (LBS) <u> 5 0 L I D</u> EXPENDABLE WT/UNIT (REF)
(PKG.WT/UNIT)(REF)
(LB) VOL/UNIT (REF)
(PKG.VOL/UNIT)(REF)
(FT3) UNITS/CYCLE(REF) TYPE YOTAL WITCYCLE (LB) DAYS/MISSION T DAYS/MISSION CYCLES/DAY 6 A S/L 1 Q U 1 D EXPENDABI · @ AMT . RECOVERED/CYCLE

O Y ()
(LB) 0 RECOVERY AMT. USED/CYCLE (REF) TYPE **FACTOR**  $\Sigma$  ①  $\Sigma$ CYCLEYDAY X DAYSYMISSION X TOYAL TOSTTCYCLE kG (18) (LB) te (1)

# D2-118561-5

HABITABILITY SUBSYSTEM	Off-Duty Activit	y
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#### APPLIANCE FUNCTIONS CONSIDERED

- 4.1.1 Music
- 4.1.2 Library
- 4.1.3 Television
- **4.1.4** Games
- 4.2.1 Exercisers

### **DESCRIPTION**

The off-duty activity habitability subsystem was designed to provide the crew entertainment and physical exercise in their off-duty hours. The subsystem considered by the study is primarily based on the off-duty equipment provided for Skylab and Apollo crews. A television receiver was the only addition to the subsystem. The Shuttle Orbiter would not utilize most of the equipment presented in this subsystem due to the present mission duration. The equipment was, however, considered for Shuttle Orbiter for the benefit of future missions as they are extended with the addition of payloads such as Spacelab.

HABITADILITY SUDSYSTEM 4.0	Off-Duty Activity
HABITABILITY FUNCTION 4.1	Entertainment
APPLIANCE FUNCTION 4.1.1	Music
NUMBER OF CONCEPTS CONSIDERE	.D1

#### **ASSUMPTIONS**

\_ \_ \_

- (1) The music appliance function provides the crewmen with music and a means of recording. A system to play the recorder through speakers mounted in the spacecraft is provided for better fidelity of sound.
- (2) The actual Skylab equipment was used for the appliance function. This was the only concept used because of the simplicity of the appliance . function.
- (3) The Skylab equipment quantities were ratioed by crew size; i.e., six men divided by three men for Space Station and four men divided by three men for Shuttle. The weight and volumes were then multiplied by these ratios.

;	TOTAL STANK STANKS						
NOTER USAGE CONSUMBLES AND TABLES	CONSUNABLES AND FLOW REQUIRENENTS	L REGHT	EC 19 8 8 8 8		MI/VOL REUMIS	DEVELOPHENT COST	RESUPPLY
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-1 CASSETTE PLATER/RECORDER				•			
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APPLIANCE CONCEPT COMPONENT SUMMARY MATRIX

APPLIANCE FUNCTION: 4.0-OFF-DUTY ACTIVITIES

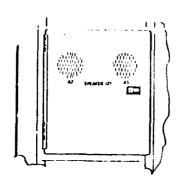
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SPACECRAFT Space Station Off-Du HABITABILITY SUBSYSTEM Activi	ty
APPLIANCE FUNCTION Mus	ic
APPLIANCE CONCEPT NO./TITLE_ INDEX NO. 4.1.1.1	REF. NO. 293, 96

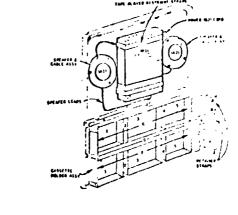
#### DESCRIPTION

The cassette player/recorder concept includes the following equipment: (1) tape player/recorder, (2) headsets, (3) microphone kit, (4) power cord/converter, (5) batteries, (6) cassette kit, and (7) wardroom speakers. The tape player can be used on conventional batteries or via a converter from 28 VDC to 6 VDC on spacecraft power. The tape recorder plays cassettes and is provided with a speaker and an adaption to headsets for private use. The number of units provided for each of the above units is summarized below:

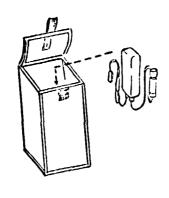
	Shuttle	Space Station
Tape recorder	5	7 .
Headsets	<b>3</b>	4
Microphones	3	4 .
Power cord/converter	1	2
Batteries	adequate duration	for mission
Cassettes	80	120
Speaker	1 ,	1



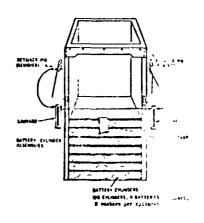
SPEATER DOOR (FRONT VIEW)



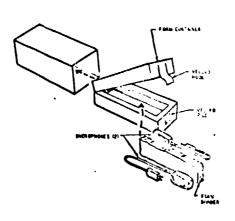
SPEAKER DOOR (REAR VIEW)



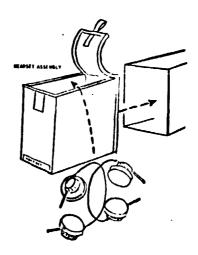
POWER CORD/CONVERTER



BATTERY DISPENSER



MICROPHONE



PENDSHIS

# CONCEPT // CASSETTE PLAYEE/KOCOICOLK INDEPENDENT ON COLUMN OF THE PROPERTY 4.1.1.1.

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		_30		60			
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SOURCE		THERMAL  LATENT (BTU/HR)	SI'NS	REMERTS STRLE J/HR)	HEAT LEAK (BTU/HR)		COOL/13 TU/HI.)
SOURCE # 03		LATENT	SI'NS	SIRLL J/HR)		(8	
	2 <i>F</i>	LATENT	SINS (BIU	SIRLL J/HR)	(BIUVHS)	(8	
PASSCITE NO	2 <i>F</i>	LATENT	SENS (BIL	51BLE 17HR) 12.3	(BIUVHS)	9)	
PASSCITE NO	2 <i>F</i>	LATENT	SFNS (BIG	51BLE 17HR) 2.3	(BTU/HR) _/02.3		TU/HL)
PASSCITE NO		LATENT	SENS (BTC) 	51BLE 17HR) 2.3	(BTU/HR) _/02.3	(E	TU/HL)
PASSCITE NO		LATENT (BTU/HR)	SENS (BTC) 	(102.3)	(BTU/HR) _/OZ.3	(E	TU/HL)
PASSCITE NO		LATENT (BTU/HR)	SENS (BTC) 	(102.3)	(BTU/HR) _/OZ.3	(E	TU/HL)
PASSCITE NO		LATENT (BTU/HR)	SENS (BTC) 	(102.3)	(BTU/HR) _/OZ.3	(E	TU/HL)
PASSCITE NO	TOTAL	LATENT (BTU/HR)	SENS (BILL)	(102.3)	(BTU/HR) _/OZ.3	(E	TU/HL)
PASSCITE NO	TOTAL	LATENT (BTU/HR)  WATT (BTU/PR)  PERATIO THERMAL	30 WATI (	(102.3) NALILES	(BTU/HR)  _/OZ.3	(E	(b)(y)(s)
PASSCITE NO	TOTAL	LATENT (BTU/HR)  WATT (BTU/PR)  PERATIO THERMAL	SENS (BILL)	(102.3) RIU/III)	(BTU/HR)  _/OZ.3  _30 (/OZ WATT (BTU/HP)	(E.	TU/HL)
ASSCITE NO	TOTAL	LATENT (BTU/HR)  WATT (BTU/PR)  PERATIO THERMAL	SENS (BILL JO)  MATI (  N. A. L. P. E.	MALILES  ELECTRICAL	(BTU/HR)	(E.	(Livyes
ASSCITE NO	TOTAL	LATENT (BTU/HR)  WATT (BTU/PR)  PERATIO THERMAL	SENS (BILL JO)  MATI (  N. A. L. P. E.	MALILES  ELECTRICAL	(BTU/HR)	(E.	(Livye)
ASSCITE NO	TOTAL	LATENT (BTU/HR)  WATT (BTU/PR)  PERATIO THERMAL	SENS (BILL JO)  MATI (  N. A. L. P. E.	MALILES  ELECTRICAL	(BTU/HR)	(E.	(Livye)

MATIS/CYCLE RATIS/CYCLE (BTU/HR/CYCLE)

TOTAL

KG/BICSION (EB/BISSION) (ELIANTZZIOA) MANGESTOA APPLICATE CONTINUES IN CONTRACTOR OF A STATE

CONCINITIONS SETTE PUNYURIAGE CONDER 1400 homes 4.1.1.1 FIXED RELGET/VOLUME REQUIPEMENTS COMPONENT (RELL) (H1') TOPE PLAYER .707 HEAUSLIS MENDSCTS MICROPHONES BATTLKILS ..... CASSETTES WARDKOOM SPEAKUES POWER COPO/CONKERTER ...... RUSUMPLY SOLID EXPENDÍBLE Y T/Y OL REQUIPEMENTS (LL) (PT') UNITS/CYCLE(REE) BATTURIES - 41.0  $\Sigma$  3 49.7 TOTAL MISSION  $\Sigma$  5 101AL LICETTE MISSION (LB) [ 22.54 (49.7)]  $X = \frac{X}{100 \text{ DAYS/BISSICK}} = \frac{X}{100 \text{ (LE)}} = \frac{X}{\text{(LE)}}$ 1.025 (.9G) DAYS/015510N X TOTAL TOTAL TOTAL (FIT) GAS/LIQUID EXPENDABLES REQUIREMENTS  $\mathbf{O}$ AMT. RECOZET D/CYCLE RECOVERY AMT. USED/CYCLE (REF.) TYPE FACTOR (LB)  $\Sigma$  (1)  $\Sigma$ TOTAL LEST CYCLE

(LB)

HABITABILITY SUBSYSTEM 4.0 Off-Duly Activity		
MARITARILITY FUNCTION A 1 Entartainment	•	
HABITABILITY FUNCTION 4.1 Entertainment		<del></del>
APPLIANCE FUNCTION 4.1.2 Library		
. NUMBER OF CONCEPTS CONSIDERED 1	•	
		•

## **ASSUMPTIONS**

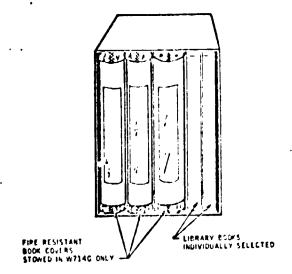
- (1) The library appliance function provides the crewmen with reading material for off-duty time. Provisions are added to make the paper books non-flammable by adding covers while the books are in use.
- (2) The actual Skylab equipment was used for the library appliance function. This was the only concept used because of the short mission duration.

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HABITABIL	Off-Du ITY SUBSYSTEM <u>Activi</u>	ty	_HABITABILITY	FUNCTION_	Entertainment
APPLIANCE	FUNCTION Libra	ry			
APPLIANCE	CONCEPT NO./TITLE_	1/Books			
INDEX NO.	4.1.2.1		REF. NO	293, 96	

#### DESCRIPTION

The book concept consists of individually selected off-the-shelf paperback books taken on the mission. The books are stored and when in use are provided with a cover for nonflammability. The covers are fabricated from Beta cloth.



CORRECT 1/Bonne

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TOTAL

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(ETO/HE/CYCL)

KG/MISSION (LR/MISSION)

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ë	¥ \$/r 1 Q u 1 p	EXPENDABLES	BEGÜLBE	MENTS	
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# D2:118561-5

HABITABILITY SUBSYSTEM 4.0	Off-Duty Activity
HABITABILITY FUNCTION 4.1	Entertainment
APPLIANCE FUNCTION 4.1.3	Visual Recreation
NUMBER OF CONCEPTS CONSIDERE	

# **ASSUMPTIONS**

- (1) The visual appliance function provides the means for programed television to be displayed on board the spacecraft.
- (2) The Panasonic and Sony television sets were the basis for the engineering numbers.
- (3) One unit was assumed to be provided for each vehicle.

CONCEPT USAGE COMSUMABLES AND FLOW REQUIREMENTS  10. 11ME ANT ANT FLOW PRESS TEMP  USES/DAY TYPE USED FLOW PRESS TEMP  WAS/USE (0) "KG/USE" (0) (PSIG) (DEG (18/USE) (0) (PSIG) (DEG 2,000)  2,000 2,000						
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NO. CONCEPT NAME						
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			!			

# D2418561-5

SPACECRAFT Space Station		
Off-Duranth HABITABILITY SUBSY. "EM Activi		FUNCTION Entertainment
APPLIANCE FUNCTION Visual	Recreation	
APPLIANCE CONCEPT NO./TITLE	1/Television	
INDEX NO. 5.1.3.1	REF. NO	1

## DESCRIPTION

(1

The television concept provides programed television programs to the crewmen. The data presented were based on 15-inch Panasonic. The Sony is also very similar to this model. The unit does not provide the means for use of video tape.

<b>C</b> 05(144)	1/14LEVISION

15

APPLIANCE CONCEPT REQUIRED NOT AND REMAINED A CALCULATIONS.

11817 Review 5.1.3.1

(H1-7H12516N)

KG/PISSION (LIG/PISSION)

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WATES/CYCLE (LIGHB /CYCLE)

WATTS/CYCLE (BTU/BR/CYCLE)

MELLAR L CACHELLE, BELLEON MAD TO THE BOX CHORESTON (CONCERNE)

CONCERT 1/TELLEVISION / MAD TO THE S.1.3.1

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OTA: UT.					
PISSION TO CYCLE/I	DAYS/RISSICY	TOTAL TOST YOUR	(10)	·	+6" (18)

HABITABILITY SUBSYSTEM 4.0 Off-Duty Activity	
HABITABILITY FUNCTION 4.1 Entertainment	
APPLIANCE FUNCTION 4.1.4 Games	
NUMBER OF CONCEPTS CONSIDERED 5	

## **ASSUMPTIONS**

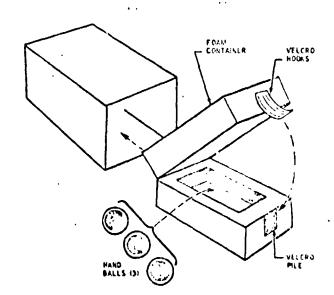
- (1) The games appliance function provides games to occupy crewman time during off-duty activity. The devices used are varied to prevent boredom.
- (2) The actual Skylab equipment was used for the appliance function.
- (3) The Skylab equipment quantities were ratioed by crew size; i.e., six men divided by three men for Shuttle. The weight and volumes were then multiplied by the ratios.
- (4) The concepts presented are not presented for trade purposes. Each of these concepts are candidates for off-duty activity equipment.

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		† †			§ 4									

SPACECRAFT	Space Sta	ation			
HABITABIL1	ITY SUBSYSTE	Off-Dut 1 Activit	y HABITABILITY	FUNCTION E	ntertainment_
APPLIANCE	FUNCTION	Games	P. S.		
APPLI/ TCE	CONCEPT NO.,	/T1TLE	1/Handball		
INDEX NO.	5.1.4.1		REF. NO.	293, 96	

### DESCRIPTION

The handball concept provides three hand balls, one pyrell, one sponge, and one rubber hand ball. The balls are covered with a nonflammable Fluorel covering. One commercial ball is coated with Fluorel. The pyrell NERF ball was dipped in ammonium-dehydrogen phosphate and coated with Fluorel. The third ball is a toy ball coated with Fluorel. The balls are ckaged in a sponge rubber container.



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(10,23 - 1 %)

TOTAL

(UTU/A /CYCLE)

APPLITURE CONCERNING THE CONCERNATION OF CONCERNATION CONCERNATIONS

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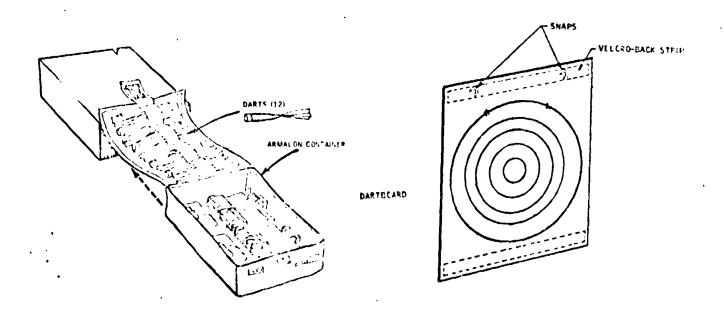
1000 to cer 5.1.4.1

WILCHIM COULDER COULDED SIS COSSIGNATION (PH) (11') HANDENCL KIT TOTAL SOILD EXPENDABLE WIVOL PEQUIFFMENTS UNITS/CYCLE (FFF) TOTAL WE/CYCLE (LB) CYCLES/DAY TO A DAYS/MISTING TO X TOOL BOLL FOR E. (1.1) CYCLES/CYCT PANE/HISSIGN TOLLY LYCYCLE (FIT) GAS/LIQUID EXPENIABLES REQUIREMENTS 0 RECOVERY MAT. USED/CYCLE (PLF)  $\Sigma \odot$  $\Sigma$  (1) CHILLYEAR TOTAL TO

SPACECRAFT Space Station Off-Du	
HABITABILITY SUBSYSTEM Activ	ity HABITABILITY FUNCTION <u>Entertainment</u>
APPLIANCE FUNCTION Games	
APPLIANCE CONCEPT NO./TITLE	2/Dart Board/Darts
INDEX NO. 4.1.4.2	REF. NO. 293, 96

#### DESCRIPTION

The dart board concept utilizes darts and board with velcro for a zero-g dart game. Twelve darts were provided with the heads covered with velcro hooks and attach to the board by means of velcro pile/hook attachment system. A dart holder container was provided as part of the concept. The system did not work well on Skylab (darts were not stable), so redesign of this system would be required prior to flight.



# CONCERT 2 / DART BOARD/ DARTS

MERCHER 4.1.4.2

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OMPONENT (REE)	(T) <u>USE</u> 11) F <b>CYCLE</b> (HR)	(2) PEAK (WATTS)	(3) AVETA E (WALLE)	(7) DEC 130 (VALL 1697 CYCLE) (DECE)	(MATT2)  LEVE	VALLYON ()	(7) 101973 (11719) (11717) (11777)
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	and the same special s						

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CONCETT 2/DART BOARD/DARTS

10017

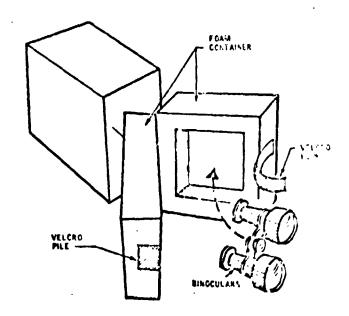
10017 WATER 4.1.4.Z

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TYPE	UNITS/CYCLE (PEF)	GLETZURÄT)(PEF) (LE)	(i) (i)	(PKG, VG	(7811) (111). (11)	4:3
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1YPE	(18)	•	AL TUR	(11)		(( ))
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SPACLOPART	Space Station Off-				
HABITABILIT'	Off- Y SUBSYSTEM Acti	Dulý vity	_HABITABILIT\	r runction_	<u>Entertainment</u>
APPLIANCE F	INCTION Games				,
APPLIANCE CO	DACEPT NO./TITLE	3/Binocul	ar Kit		
INDEX NO	4.1.4.3		_kEr. NO	293, 96	

The binocular kit concept provides binoculars for viewing distant objects such as earth and satellites. The binoculars are "trinovid"  $10 \times 40$ , manufactured by E. Leitz, Inc. velcro attachment strips are provided for attachment when used in specified areas.



CONCEPT 3/BINOCUCIR KIT THE CONCEPT REQUIPETERS AND PERMETES CARCULATIONS INDEX

INDEX HUMBER 4.1.4.3

	$\sim$		LONE	R	p c	POWE	<u>R</u>
APONLINT (REF)	USE JIM CYCLE (HR)	(HATTS)	(WATES)	(4) DEMAND (WATT-HE/ CYCLE) (1) x (3)	© PEAK (WATTS)	(MATTS)	(7) DEMAN (IIAT1-H CYCLL) (1) X (7
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		NUMERAN		TOTAL	MAXIMUM	•	TOTAL
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	and - 4 <sub>2-12-12-12</sub> -12-12-13-14-14-14-14-14-14-14-14-14-14-14-14-14-						
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·	HEAT	THERMAL TO	COOL ANT	ELECTRICAL	WEIGHT		OLUME
SOURCE	(BTU/HR/	CYCLE) (BTU	/HR/CYCLE)	(PK WĄTTS/CYC	LE) (LB/MISSI	DN) (FT'	/MISSION)
N/A					<u> </u>		- <del></del>

C,4

TOTAL

WATTS/CYCLE (BTU/HR/CYCLE)

13/5

KG/MISSION (LB/MISSION) WATES/CYCLE (BTU/HR/CYCLE)

APPEIANCE CONCEPT REQUISEMENTS AND FEMALETE'S CALCULATIONS (CONCEDED) CONCERT 3/BINOCULIE KIT 1801 x NUMBER 4.14.3 WEIGIJ/VOLUME REQUIREMENTS WE TOUT (1.05) VOLUME (FT!) COMPONENT (RLF) BINGCULAR KIT TOTAL KG (LBS) EXPENDABLE W 1/V 0 L <u>REQUIREMENTS</u> WT/UNIT (REF)
(PKG.WT/UNIT)(PEF)
(LB) VOL/UNIT (REF)
(PKG.VOL/UNIT)(REF)
(FT3) TYPE UNITS/CYCLE (REF)  $\Sigma$ TOTAL UT. = CYCLES/DAY DAYS/MISSION TOT.WI/CICLE (LB) TOTAL VOL. MISSION CYCLES/DAY DAYS/HISSION X TOT.VOLVEYELE (FT3) REQUIREMENTS GAS/LIQUID EXPENDABLES AMT.RECOVERED/CYCLE

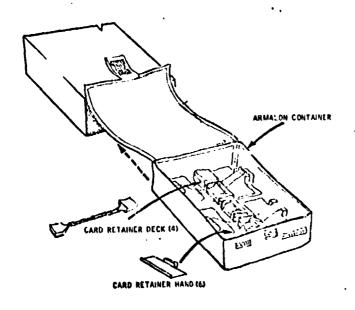
① X ②

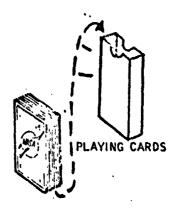
(LB) RECOVERY AMT.USED/CYCLE (REF)
(LB) N/A  $\Sigma$  (4) T DAYSZMIBSION TOTAL LOST/CYCLL (20 (40) (LB)

15

SPACECRAFT_	Space Stati	ion	•		·
HABITABILITY	SUBSYSTEM	Off-Duly Activity		_HABITABILITY	FUNCTION Entertainment
APPLIANCE FU	NCTION	Games	٠.		
APPLIANCE CO	NCEPT NO./T	ITLE 4/Card	<u>s</u>		
INDEX NO	4.1.4.4			REF. NO	293, 96

The cards concept provides card decks and card deck retainers for card playing in zero-g. The card retainer is constructed using a flexible strap with a magnet at each end. The assembly is covered with Beta cloth. The cards are standard cards manufactured using a lamination of three layers of Scheufelin paper E-20. Each deck is stored in an aluminum container for nonflammability. Eight decks of cards were assumed for Space Station and four for Shuttle.



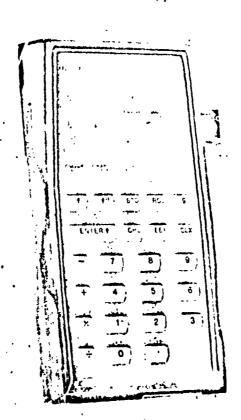


CONCIPT 4 /CARDS		/	65A (CBERT) (1094		INDEX 1	10000 P <u>4.1</u>	4.4.
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COMPONENT (REF)	USE TIME CYCLE (HR)	(E) PEAK (WATIS)	(3) AVERAGE (WATTS)	(4) DETAND (WATT-HEY CYCEE) (1) X (3)	(5) PEAK (WATTS)	POWE  AVERAGE (WATTS)	R (7) DEL'AN (MATT-H CYCLL) (1) Y (7
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		PUNIXAM	~	TOTAL	MAX 1 MUM	•	TOTAL
N/A	and the state of t						
	TOTAL	WATT (BTU/HF	R) WATT	(вти/нк)	WATT (BTU/HR)	WATI	(BTU/HR)
•	, ,	<u>PERAII</u>	ONAL PE	ENALILES			
SOURCE	HEAT (BTU/HR	THERM/	AL TO COOLANT (BTU/HR/CYCLE)	ELECTRICAL (PK WATTS/CY	WEIGHT		VOLUME 3/MISSION)
	(BIO/IIK	/CTCLL)	(BIO) TRACELY	TER MULISICA	(11)	,,,,	· /#/3310K/
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ĭ	OT/: WATT (BTU/	S/CYCLE	WATTS/LYCLE (BTU/HK/CYCLE)	,	KG/MISSIC (LB/MISSIC	)))	/MISSION (

CONCEPT 4/CARL	##N.1781G CONG 2 <b>.5.</b>	PT PI QUIPE : A RE	S AND TESTEMS (	vrentvrioi <sup>i)</sup> (e	Catorio) Indix tom	ar 4.1.4.4
COMPONENT CARDS / RE STORAGE	(RL+)	 M	01 UHE RI WITCHI (185) 6-68	Q	u i s	vocuma (11°) ./ 7.3
	, TOTAL		3.03 (6.	.68)	.00	748 (173) M³ (11³)
TYPE N/A	SOLID EXP	E H D A B L E  WT/URL1 (PL)  (PKG.WT/URL1)  (LB)	M 1/V 0 L (PEF) ① X (	CLE VO	EMENIS  L/UNIT (REF)  LVOL/UNIT)(FF)	(5) VOI / CYTL L ) (1) x (4) (11)
			Σ3 - Tō1ΛL LY (8.1)	/tyul -	Σ	JULK NO VENUL
OTAL VOL	<b>Y</b>	YS/HISSION —	X	L'E		KĠ (LB)
TYPE N/A	<u>G A S/L 1 Q U 1 D</u> AMT. USED/C	D		REQUIRE	MENIS  HENIS  LEFEN/CYCLE  X (2)  LB)	AMT LOST/CYCLE (1)-(3) (LB)
OTAL UT	ΣΦ				Σ	
OTAL WT MISSION	YUAY TOAYSYMIS	STON - " TOTAL	) ost/chale * (z (d)	(LB)	(z (i)	KG (EN)

SPACECRAFT Space Station		
HABITABILITY SUBSYSTEM Activ		FUNCTION Entertainment
APPLIANCE FUNCTION Games		
APPLIANCE CONCEPT NO./TITLE_	5/Calculator	
INDEX NO. 4.1.4.5	REF. NO	and the second s

The calculator concept provides a Hewlett-Packard HP-65 programable pocket calculator. The calculator is an electronic slide rule with programable tapes for special programs. The study assumed four units were supplied for Shuttle and six for Space Station.



APPLIANCE CONCERT PERMITMENTS AND FINALLIES CALCUEATIONS WHIT 5/CALCULATOR INDEX NOBER 4.1.4.5 ELECTRICAL POWER PEQUIPERENTS AC POWER

DEGAD DC PORTR \_ @ ... **(5) (6)** 01.77110 (MAT1-HP/ (RATT-H97 CYCLE PEAK AVEPAGE PEAK AVERAGE (1) x (3) CYCLE) (REL) (HR) (WAT15) COMPONENT (WATES) (WATTS) (WATTS)  $(1) \times (1)$ ...25... ...5... CALCULATOR ...... 1.25 MULTIXAN 10TAL MAXIMUM IATOT THERMAL REQUIREMENTS LATENT SENSIBLE HEAT LEAK TO COOLANT SOURCE (BTU/HR) (BTU/HR) (BTU/HR) (BTU/HC) CALCULATOR \_17\_\_\_ \_\_\_\_17\_\_\_\_ 5 (17) TOTAL WATT (BTU/HR) WATT (BIU/HE) QPERATIONAL PENALTIES THERMAL TO COOL ANT ELECTRICAL WEIGHT **VOLUME** HEAT LEAK (PK WATTS/CYCLE) (LB/MISSION) SOURCE (BTU/HR/CYCLL) (BTU/HR/CYCLE) (FT3/MISSION) N/4

C2-640

KG/MISSION

(LB/HISSION)

M-VRISSION

(FT '/MISSION)

WATTS/CYCLE

(BTU/HR/CYCLE)

TOTAL

WATTS/CYCLE (BTU/HR/CYCLE)

APPLIANCE CONCERT DESCRIPTIONS FOR EASTERES CALCULATERS, (CASCEDEND) INDEX ROPPER 4.1.4.5 CORCLET 5/ CALCULATOR WIIGHT/VOLUME REQUIFIMENTS C005/05/E81 CALCULATOR - 4.12 BATTERY PACK CHARGEK TAPE UNITS (40) .0037 (.129) TOTAL EXPENDABLE WIVOL REQUIREMENTS VOLVUNII (REF) (PKG.VOLVUNII)(PEF) TYPE UNITS/CYCLE (REF) TOTAL WT/CYCLE TOTAL VOL/CYCLE CYCLUS/DAY DAYS/MISSION X TOT.WI/CYCLE (LB) CYCLES/DAY X DAYS/HISSION X TOT. VOL/CYCLE (FT') GAS/LIQUID EXPENDABLES REQUIREMENTS RECOVERY AMT. USED/CYCLE (RLF) TYPE FACTOR  $\Sigma$  ① ...  $\Sigma$ 

C2-641

CYCLETUAY - X DAYSTMISSION X TOTAL LOSITALILL

### ·D2-113561-5

HABITABILITY SUBSYSTEM 4.00ff-Duty Activity	
HABITABILITY FUNCTION 4.2Physical Conditioning	
APPLIANCE FUNCTION 4.2.1Exercisers	_
NUMBER OF CONCEPTS CONSIDERED 2 .	

### **ASSUMPTIONS**

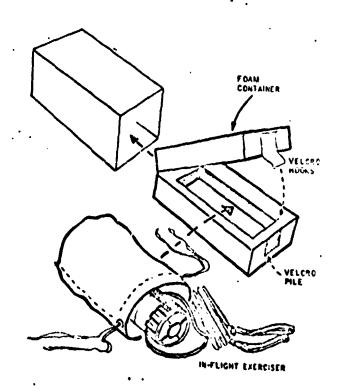
- (1) The exercisers appliance function provides for maintenance of crewman physical condition under the influence of zero-gravity.
- (2) The actual Skylab equipment was used for the appliance function.
- (3) The Skylab equipment quantities were ratioed by crew size; i.e., six men divided by three men for Space Station and four men divided by three men for Shuttle. The weights and volumes were then multiplied by the ratios.
- (4) The concepts presented are not presented for trade purposes. Each of these concepts are candidates for off-duty activity equipment.

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Section 11 (10) (12) (10) (10) (10) (10) (10) (10) (10) (10	TIME CONSUMBLES AND FLOW REG	THERMAL REGATS	ELEC POR REQUIS	PT/VOL REGHTS		
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SPACECRAFT Space Station OFF-DO HIABITABILITY SUBSYSTEM Activi	ity HABITABILITY FUNCTION Conditioning
APPLIANCE FUNCTION Exercis	
APPLIANCE CONCEPT NO./TITLE	1/Exer-Gym
1NDEX NO 4.2.1.1	REF. NO293, 96

The exer-gym concept is a commercial grade of exer-gyms manufactured by Exer-Genie. The unit provides exercise by means of varying rope tension to produce the desired push/pull restraint forces. Exer-gym works by putting each foot in the strap loops and pulling rope with one or two hands. A storage container is provided for the exer-gym. The study assumed four exer-gyms were provided for Shuttle and six for Space Station.



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CONCEPT I/EX	KK-G	YM APPLIA	act <b>c</b> oncert may	91813181818 PAD	PENALTIE : CALC	GLATIOUS INDEX	можеск <b>4,</b> 2	2.1.1.
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				Property of the second				
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		TOTAL	WATT (BTU/HR)	and the Table	(BTU/HR)	WATT (BTU/HR)		/PTU (MD)
\$0URC			PERATIO THERMAL LEAK TI CVELE) (BTI		NALILES  ELECTRICAL (PK WATTS/CYC	WEIGHT	Y	OLUME /MISSION)
**************************************					higher (high vita is resigned to a	The Augustin grown	and district the second	

KG/MISSION (LB/MISSION) (H)/H15510% (H)/H15510%

WATES/CYCLE (BIJ/HR/CYCLE)

TOTAL

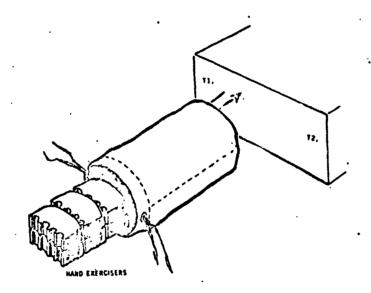
WATTS/CYCLE (BTU/HR/CYCLE) APPLIANCE CONCEPT PER MELTINAS AND PERALLEES (ALCOHAFICAS (CONCEDED)

1800 x 10001 FR 4.2.1.1 WHITH // LXCK- GYM Flyrn WELGET/VOLUBL REQUIPEMENTS NETSHI (LBS) EXURGONI 1,98 .010 (.36) TOTAL EXPENDABLE HI/YOL REQUIREMENTS 0 UNITS/CYCLE(REF)  $\Sigma$ TYOTAL WIVEYELE TOTAL VOL/CYCLE
(F1.) CYCLES/DAY DAYS/HISSION X 101. WI/CYCLE ---CYCLES/DAY DAYS/HISSION X YOLLYOLYCYCLE (FT.3) GAS/LIQUID EXPENDABLES REQUIREMENTS AMT.RECOVER BYCYCLE RECOVERY AMT. USED/CYCLE (REF) TYPE  $\Sigma 0$ TDAVS/RISSIONT X YORKE FOST CICLE

SPACECRAFT Space Station Off-Duty HABITABILITY SUBSYSTEM Activity	HABITABILITY	Physical FUNCTION Conditioning
APPLIANCE FUNCTION Exercisers		
APPLIANCE CONCEPT NO./TITLE 2/8	Hand Exerciser	
INDEX NO. 4.2.1.2	REF. NO	293, 96

O

The hand exerciser concept is provided to keep hand and arm muscle condition. The hand exercisers are shaped to fit the hand and are used as a "squeeze" type exerciser for maintaining grip strength. The units are coated with Fluorel for nonflammability. The study assumed four hand exercisers were provided for Shuttle and six for Space Station.



APPLIANCE CONCEPT REQUIREMENTS AND PENALTIES CALCULATIONS CONCEPT 2/11/14/D EXERCISER

INDEX NORBER 4,2.1.2

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SOURCE N/A	TOTAL	LATENT (BTU/HR)	SENS!	PLE (HR)	(BTU/HP)		STU/HP)
SOURCE N/A		LATENT (BTU/HR)  WATT (BTU/HR)  OPERATION	SENS.	PLE (HR)	(BTU/HP)  WATT (BTU/HR)	(E	(Blu/HR)
SOURCE N/4	. <b>`</b>	LATENT (BTU/HR)  WATT (BTU/HR)  OPERATION THERMAL TO	SENS.	TU/HR)	(BTU/HP)  WATT (BTU/HR)	(E	STU/HP)

WATTS/CYCLE WATTS/CYCLE (BTU/HR/CYCLE)

TOTAL.

(LB/MISSION)

(KOTSSIDA, LE WASSIDA, WASSIDA

# D2-118561-5

APPLIANCE CONCLETEREQUIPMENTED AND TENNETTED COLORATIONS (CO. RELIGIO)

CONCIPI 2/HAND EXCESER	•		•• '	1 HOLK HOMBER 4.2.1.	2
•		•			

CORPOSERI HAND EXEX	11.X 2C15E72S	(RLI)	1 6 11 17 0 1 11	We tent (LUS)			VOLUME (HT') 039
TYPE N/A	SOLID  UNITS/CYCL	W (Pk	•	· ③	<u>R E Q U I R</u> I	EMENIS  (4)  L/URIT (PFF)  LVOL/URIT) (REF  (FT2)	AOLYCYCIT
TOTAL VOL	ILLS/DAY	DAYS/M	¥	101AL W1/C (LB)	# 	Σⓒ	KG (LB)
Түре <i>N /Ө</i> -	<u> </u>		EXPENDA	TOT. VOI /CYCL (FT 3)  B L E S R  - ②  RECOVI RY  FACTOR	EQUIRE MAT. RECOVE	3 ERED/CYCLE	AMT 1051/CYCLE (1)-(3) (LB)
TOTAL WT.	Σ ① γ <sub>ρλΥ</sub> x	DÄYS/H18S10N	* toral lost	/cvc.c	*	Σ.	re (ris)

D2-118561-5

HABITABILITY	SURSYSTEM	Medical	•
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### APPLIANCE FUNCTIONS CONSIDERED

- 5.1.1 Autoclaves
- 5.2.1 Ergometers

### DESCRIPTION

The medical appliance subsystem considered by the study were those items judged to have a direct interface with the ECLSS. The Space Station will probably include more appliances than were considered in this section; however, the autoclave and ergometer appliances were the only appliance functions defined for a near term Space Station. The Shuttle Orbiter, because of its short-term mission, would not require these appliances. These appliance functions were, however, complied for possible application to future Shuttle missions.

)	HABITABILITY SUBSYSTEM 5.0	Medical	
	HABITABILITY FUNCTION 5.1	Sterilization	•
	APPLIANCE FUNCTION 5.1.1	Autoclaves	
	. NUMBER OF CONCEPTS CONSIDERS	ED 3	•

### **ASSUMPTIONS**

(1) Venting of the autoclave chamber to vacuum was allowed since the contamination level was considered low.

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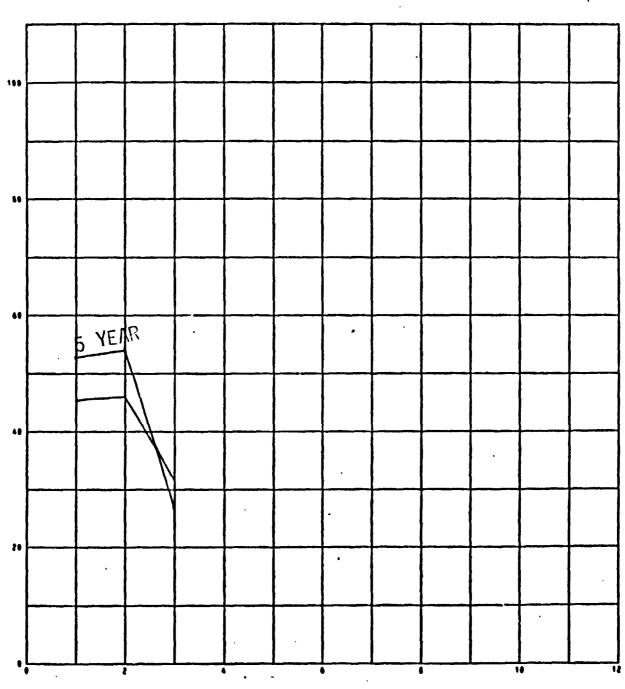
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2 - 087 MEAT 3 CTHYLENE	301 ro						7 - MITROSEN 8 - FREGN 9 - WATER		(USED) (USED) (CIRCULATED); (PROCESSED);		(16/ER) (18/ER) (18/ER)		! !
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APPLIANCE
CONCEPT
NO. ... CONCEPT.NAME.....

- MOIST HEAT

E - GRY HEAT

3 -. ETHYLENE OXIDE



CONCEPT NUMBER

Autoclaves (Space Station) Concept Trade C2-653

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APPLIANCE FUNCTION: 5.1.1-AUTOCLAVES

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	TYPE	<u>e</u>				
	COMPONENT TYPE	APPLIANCE TYPE	AUTOCLAVE, MOIST HEAT	AUTOCLAYE, DRY HEAT	AUTOCLAVE, ETHYLENE OXIDE	

### D24185 1.5.

SPACECRAFT Space Statio	n		•	
HABITAGRETTY SUBSYSTEM_	Medical	HASTEGALI	TY FUNCTION Sterilization	n
APPLIANCE FUNCTION_	Autoclaves			
APPLIANCE CONSEPT NO./TI	TLE 1/Moist	Hest Clerili	izer	
INDEX NO. 5.1.1.1		MEF. NO.	202	
DESCRIPTION				

The moist heat sterilization concept utilizes high temperature saturated steam as the agent for sterilization. The advantages of this system are its rapid heating, penetration, and moisture which facilitate the coagulation of proteins. This is the mechanism by which the organisms are destroyed. The units sterilization operating temperature range is 121 °C to 132°C (250°F - 270°F). The period of time used for this method of sterilization was assumed to be 15 minutes at 1551 mmHg (30 psia). The air within the autoclave was assumed to be exhausted overboard prior to each sterilization cycle to assure efficient sterilization. The volume of the chamber used for computing the vented gas was .0504 m³ (1.78 ft³). The water used per cycle was 0.072 kgms/use (0.158 lb/use) which is recondensed and recovered.

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MITTARE CONTEST. HUNT. SICRILIZATION	Mangas van berverne enemerikas :	India herrien	5.1.1.1
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OBSOMENT (REE)	, ,	(E) PEAY (WALTS)	(3) AVERAGE (WALLS)  845	DENAUD (EATT 187 (YCLE) (D) F (3)	(E) ILAK (WATTS)	C POWE (6) AVERAGE (MATTS)	DEMANDE (D) X (A) X (A) X (A) X (A) X (A)
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SOURCE N/A	HEA!	THERMAL TO	COOLANT	FLECTRICAL			
SOURCE N/A	HEA!	THERMAL TO	COOLANT	FLECTRICAL			
SOURCEN/A	HEA!	THERMAL TO	COOLANT	FLECTRICAL			DLUME (MISSION)
SOURCE N/A	HEA!	THERMAL TO	COOLANT	FLECTRICAL			

TOTAL

WATTS/CYCLI (BTU/IIK/CYLLL)

MATTS/CYCLE (BTU/HP/CYCLE)

k5/MINS10% (LB/RISN10N)

(FT (MISSICH)

water 17.11016.	HEAT. STURILIZAT		1994 x 1994 R 5.7.
<b>с</b> опношит	(REF.)	ACTORITY REQUIRER SHINN OF RRF RESERVED	VOLUME (111)
AUTOCLAVE	ASSY (202)	30	
	TOTAL	[ 13.6 (30)]	.158 (3
	<u>. SOLID EXPEND</u>	KG (LBS)	м <sup>3</sup> (11 <sup>3</sup> ) : <u>Емінт</u> <u>S</u>
Түре		Ø 3	(4) (6) (6) (6) (6) (6) (6) (6) (6) (6) (6
K/A			
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		∑③ TOTAL WY/CYCLE (LB)	\(\sum_{\text{total Act }}\)
TOTAL WI. , MISSION CY	CLFS/ĐĀY DĀYS/MIS	STON TOT WT/CYCLE	K6 (LB)
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	<u>GAS/LIQUID E</u>	, ,	T M E N T S
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TYPE	AMT, USED/CYCLE (R (LR)	FACTOR	(Lib) (Li (Lib) (Li) (Li) (Li) (Li) (Li) (Li) (Li) (Li
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C2-C61

SPACECRAFT Space Stat	ion	-	•
HABITABILITY SUBSYSTEM_	Medical	HABITABILITY FO	JHCTION Sterilization
APPLIANCE FUNCTION	Autoclaves		•
APPLIANCE CONCEPT NO./TI	TLE 2/Dry Heat	Sterilization	
INDEX NO	•	REF. NO.	202

The dry heat sterilization concept uses dry heat as the sterilization agent. This concept requires much higher temperatures and longer exposure times than Concept 1. The study assumed a 2 hour sterilization time period at 320°F. The dry heat destroys organisms by means of exidation of their intercellular constituents. The unit will sterilize everything but aqueous materials because of its low vapor pressure. The dry heat chamber (1.78 ft³)was assumed to be insulated with a .038 meter (1.5 inch) thick polystyrene foam (see attached figure). The heat leak calculated was based on this insulation system. In addition to the 2 hour sterilization period, a 20 minute warmup time was assumed.

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# D2-H35GI-5

APPEIANCE CONCLETE PEQUIFICATIONS AND PERMETHS CALCULATIONS.

COHELPT ZIDZY. HCAT.	STUCIL	IZATION			THUE Y	NUMBER 5.1	. کم این
	FIFC		20 W F R	PEQUIE	EMEHIS		
COMPONENT (REE) .HLATURL (202)	(HK) CACLE THE CACLE	(2) PEAK (NATTS)	9 0 W 1 (3) AVLEAGE (WALLS) 259	BERTON (15.711-1197) (17.711-1197) (17.711-1197) (17.711-1197) (17.711-1197)	(5) PEAN (WATTS)	(WALLS)	BERGO WALL BY CYCLED (D)X()
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and a sequence of the second sections of the second sections.		**********			makes the appear the later		
		management around the sign					
		BOO MAXIMU4		596_ TOTAL	MAXIMUM	٠	TOTAL
SOURCE		LATENT (BTU/HR)		STBLF J/HR)	HFAT LEAK (BTU/HR)		COOLANT TU/HR)
STERILLEATION P					50	<u></u>	
COOLDOWN PEPI		production of the desired of the second of t			1388		
		de des Aguston Abraham administra e e e e e e e e e e e e e e e e e e e				-	and an article
	TOTAL	WATT (BTU/HR)	WATT (	ВТИ/НК)	421 (143. WATT (BTU/HR)		(BTU/HP)
	٠ . و	PERATION	AL . P.E.	NALILES	<u>3</u>		
SOURCE	HEAT (BTU/HR,		COOLANT /HR/CYCLE)	ELECTRICAL (PK WĄTTS/C)			VM122108) OFAME
N/A					•		
	<del> </del>			Transferrence (Control of the Control	<del></del>		
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NATTS/CYCLE (BTU/HR/CYCLE) WATTS/CYCLE (BTU/HR/CYCLE) (LB/MISSION)

IATOT

MY/MISSION (ITYMISSION)

# D2 118561-5

APPLIANCE CONCEPT PROPERTIES. THE FEMALES CALCULATED (COLORED)

CONCEPT 2/D2Y HEAT STERICIZATION

TABLE FORMER 5.1.1.2

	· Illato M	ET CHINA OF A HE	RIQUIFINENTS	
COMPOSE IN AUTOC CALLE WITH INSU	(RII) - 1554 (202) UNTION - (NU)	we 1907 (LES) 		volum (11.) 4.78
	.,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,			
	TOTAL	/0.9 K6 (LES)	(24)	.14 (4.79)
	SOLID EXPE	W b V b i e h 1/h o r	REQUIREMENTS     O	<u> </u>
TYPE N/A	① (UNITS/CYCLE(REL)		/CTCLE VOL/USTT (PEI )X (?)	) VOLVEYOLE
		∑③ <sub>101/4</sub>	WI/CYCLT (LB)	TOTAL VELYCACTE
TOTAL UT. : TMISSION : CY	CLES/DAY DAYS	X TOT WIZE	cyclic	KG (FR)
TOTAL VOL. MISSICH CY	CLES/DAY DAVS	X X TOT, yel (FT		·····································
	<b>c v 2/F I d ñ I b</b>	<u>EXPENDABLES</u>	<u>R</u> EQUIREMENTS	
TYPE	AMT.USED/CYC (LH)	RECOVERY FACTOR	MT.RECOVERED/CYCLE Ux⊘ (LB)	AMT LOST/C/CLE (1) (1) (1b)
P. Note College allows in an analysis of the state of the	ΣΦ		Σ	D
TOTAL WT.	<b>X</b>			•
CYCL	EZDAÝ TO BAYS/MISSI	OF TOTAL LOST /CYCLE (4)	(18) (2 ①	KG (LB)

### D2 118561-5

SPACECRAFT Space Stati	on	-	• •	
MABITABILITY SUBSYSTEM	Medical	_HABITABILITY	FUNCTION Sterilization	_
APPLIANCE FUNCTION	Autoclaves			_
APPLIANCE CONCEPT NO./TI	TLE 3/Ethylene	Oxide Steril	izer	
INDEX NO. 5.1.1.3		_REF. NO	202, 292	_

DESCRIPTION

The ethylene oxide sterilizer concept uses a mixture of Freon 12 and ethylene oxide as a sterilant agent. The sterilizer was assumed to operate at  $54~^{\circ}\text{C}$  (130 $^{\circ}\text{F}$ ) temperature, 1337 mmHg(22 psia) pressure, and at a relative humidity of 40%. The water used to raise the humidity and the air required evacuated prior to usage were assumed loss after each cycle. Since ethylene oxide is extremely flammable in air, mixtures of 88% Freon 12 and 12% ethylene oxide or 90% carbon dioxide and 10% ethylene oxide to circumvent this problem. The ethylene oxide sterilant mixtures are toxic and corrosive. A design using this concept would require careful interlocking of the chamber door to prevent accidental injury. The internal volume of the chamber was assumed to be .05 m³ (1.78 ft³) with approximately .003 pounds of water per charge for maintenance of relative humidity. The sterilant mixture is exhausted after the sterilization cycle is complete. The study assumed 20 hours were required for sterilization with a 5 minute warmup period. The cylinders used for the sterilant mixture were assumed to be aluminum.

# D2-113561-5

# CONCEPT 3/6/HYCLNE OXIVE SIEKIKIZATION THOUSAND PERMITTES CALCULATION THOUSANDER 5.1.1.3

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Z.30  RAXINGM TOTAL  LATENT SLASTELL HEAT LEAR. TO COOLANT  SOURCE (BTU/HP) (BTU/HR) (BTU/HR) (BTU/HP)  WARMUP PERIOD  STERI-TRATION PERIOD  TOTAL  MAIT (BTU/HR) MAIT (BTU/HR) MAIT (BTU/HR) WATT (BTU/HR)  OFF RAILON AL PERALLIES  HEAT LEAK TO COOLANT FLECTRICAL MEIGHT VOLUME	THERMAL BEQUIREMENTS  LATENT SLASSEL HEAT LEAR TO COOLANT  WALL BETWARD BETWARD MATT (BTU/HR) WALL BETWARD WATT (BTU/HR)  OF ER AT LOW AL PER ALT LES  METATICAN TO COOLANT FLECTRICAL METAND WOLUME  SOURCE (BTU/HR/CYCLL) (BTU/HR/CYCLL) (PK MATTS/CYCLT) (ED/HSSSION) (FT/MISSION)	HUNTER (20)	(HP) 20.1	(2) PEAK . (WATTS)	(3) AVERAGE (WATES)	(4) (EATE BEZ (ACE) (1)) (3)	(MATTS) PEAK (5)	(O) AVEJEZGE	P (7) DETAM (PATT B CYCLE) (1) X (7
THERMAL PEQUIREMENTS  LATENT SUBSECT HEAT LEAR: TO COOLANT (BTU/HR) (BTU/HR)  SOURCE (BTU/HP) (BTU/HR) (BTU/HR) (BTU/HR)  WARMUR PERIOD  TOTAL  MATT (BTU/HR) MATT (BTU/HR) MATT (BTU/HR) MATT (BTU/HR)  MATT (BTU/HR) MATT (BTU/HR) MATT (BTU/HR) MATT (BTU/HR)  MEAT LEAR TO COOLANT ELECTRICAL MEIGHT VOLUME	THERMAL PEQUIREMENTS  LATENT SLASSBIL HEAT LLAR TO COOLART SOURCE (BTU/HP) (BTU/HR) (BTU/HP) (BTU/HP)  WARMUP PERIOD  TOTAL  MATT (BTU/HR) MATT (BTU/HR) MATT (BTU/HR)  WATT (BTU/HR) MATT (BTU/HR) MATT (BTU/HR)  **OPERATION PERIOD  **OPERATION AL PERIALITES  **HEAT LEAK TO COOLART FLECTRICAL MEIGHT VOLUME **SOURCE (BTU/HR/CYCLE) (BTU/HR/LYCLE) (PK MATTS/CYCLE) (LB/PISSION) (FT*/MISSION)								
SOURCE (BTU/HP) SENSIBLE HEAT LEAK TO COOLANT SOURCE (BTU/HP) (BTU/HR) (BTU/HP)  WARMUP PERIOD 50  TOTAL 112 (381)  MAIT (BTU/HR) MATT (BTU/HR) MATT (BTU/HR)  WATT (BTU/HR) MATT (BTU/HR) MATT (BTU/HR)  MATT (BTU/HR) MATT (BTU/HR) WATT (BTU/HR)  MATT (BTU/HR) WATT (BTU/HR) WATT (BTU/HR)  WATT (BTU/HR) WATT (BTU/HR) WATT (BTU/HR)  WATT (BTU/HR) WATT (BTU/HR) WATT (BTU/HR) WATT (BTU/HR)	SOURCE (BTU/HP) (BTU/HR) (BTU/HP) (BTU/HP) (BTU/HP)  WARMUP PERIOD 50  STEPILIZATION PERIOD 33.1 - 112. (381)  WAIT (BTU/HR) WATT (BTU/HR) WATT (BTU/HR) WATT (BTU/HR)  OPERATION AL PERALLIES  HEAT LLAK TO COOLANT ELECTRICAL WEIGHT VOLUME  SOURCE (BTU/HR/CYCLE) (BTU/HR/CYCLE) (PK WATTS/CYCLE) (LB/MISSION) (FT'/MISSION)						MAXIMUM		TOTAL
TOTAL	TOTAL  MATT (BTU/HR)  WATT (BTU/HR)  WATT (BTU/HR)  WATT (BTU/HR)  WATT (BTU/HR)  WATT (BTU/HR)  WATT (BTU/HR)  WATT (BTU/HR)  WATT (BTU/HR)  WATT (BTU/HR)  WATT (BTU/HR)  WATT (BTU/HR)  WATTS/CYCLE)  WEIGHT  WOLUME  SOURCE  (BTU/HR/CYCLE)  (BTU/HR/CYCLE)  WATTS/CYCLE)  (CB/MISSION)  (FT'/MISSION)		;				HEAT LEAK	10	COOLANT
TOTAL  WATT (BTU/HR)	TOTAL  WATT (BTU/HR)			LATENT	SLNS	I PLE	(BTU/HR)		
THERMAL HEAT HEAK TO COOLANT FLECTRICAL WEIGHT VOLUME	THERMAL ELECTRICAL WEIGHT VOLUME  HEAT LEAK TO COOLANT ELECTRICAL WEIGHT VOLUME  SOURCE (BTU/HR/CYCLE) (BTU/HR/CYCLE) (PK WATTS/CYCLE) (LB/MISSION) (FT /MISSION)	WARMUP PER STERILIZATION	IOD_ N_PERIOD	LATENT (BTU/HP)	SLNS	I PLE	(btu/HR)50 _331	(B	TU/HP)
THERMAL FLECTRICAL WEIGHT VOLUME	THERMAL ELECTRICAL WEIGHT VOLUME  HEAT LEAK TO COOLANT ELECTRICAL WEIGHT VOLUME  SOURCE (BTU/HR/CYCLE) (BTU/HR/CYCLE) (PK WATTS/CYCLE) (LB/MISSION) (FT MISSION)	WARMUP PER STERVARATION	IOD _ N_PERIOD	LATENT (BTU/HP)	SLNS (BTU	TELE /HR)	(BTU/HR)5033.1	(E	TU/HP)
HEAT LEAK TO COOLANT ELECTRICAL METON VOLUME	HEAT LEAK TO COOLANT ELECTRICAL METANT VOLUME  SOURCE (BTU/HR/CYCLE) (BTU/HR/CYCLE) (PK WATTS/CYCLE) (LB/MISSION) (FT /MISSION	WARMUP PER STERVARATION	IOD _ N_PERIOD	LATENT (BTU/HP)	SLNS (BTU	TELE /HR)	(BTU/HR)5033.1	(E	TU/HP)
	U/A	WARMUP PER STERVARATION	TOTAL	LATENT (BTU/HP)  WATT (BTU/HR)	SLNS (BTU	TRIE /HR)  BTU/HR)	(BTU/HR)5033.1	(E	TU/HP)
		WARMUP PER STERILIZATION	TOTAL HEAT	LATENT (BTU/HP)  WATT (BTU/HR)  PERATION THERMAL	SLNS (BTU	IBLE /HR)  BTU/HR)  N.A.L.I.I.E.S  ELECTRICAL	(BTU/HR)  50  331  112 (38)  WATT (BTU/HR)	(E	(BIU/HF

WATTS/CILLE (BTU/HR/CYLLE) H (M) SSION (IT (M) SSION

FOLGSTMADA (KOLGSTMADA)

TOTAL

WATTS/CYCLE (BTU/HR/CYCLE)

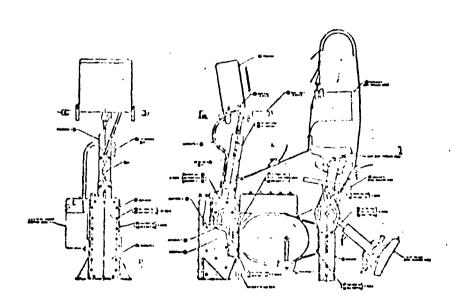
APPLIANCE CONCERT REQUIETERS 750 CONTINUES CARRESTED (CONCERN) INDED NORTH 5.1.1.35 CORLLIA 3/ETHYLENE DXIDE STURILIZATION EIXLD WEIGHT/VOLUME REQUIREMENTS AUIOCLAVE (201) WALLIAMING GOTTLE .256 (9.03) TOTAL KG (LBS) M3 (111) SOLID EXPENDABLE MINOL REQUIREMENTS UNITS/CYCLE (PEE) WATER BOITLE .0054 1.256 .00683 STLEILANT BOTH .07609 6.4 .48697 .245 .015642 - CYCLLYDIA - X - 184 - X - 4938 - (141.21 (90.8)) GAS/LIQUID EXPENDABLES REQUIREMENTS RECOVERY AMT. USED/C LLE (REF) WATER .003 (502) N/A N/A .003 STERILANT 2.092 (202) N/A N/A 2.092 CABIN AIR .132 (202) N/A N/A .132  $\Sigma$  ① 2.227  $\Sigma$  @ 2.227... 

# D2-118561-5

HABITABILITY SUBSYSTEM 5.0 Medical
HABITABILITY FUNCTION 5.2 Physical Monitoring
APPLIANCE FUNCTION 5.2.1 Ergometers
NUMBER OF COMMEPTS CONSIDERED 1 3
ASSUMPTIONS
None ·

SPACECRAFT Space Station	· Division 1
HABITABILITY SUBSYSTEM Medical	Physical HABITABILITY FUNCTION Monitoring
APPLIANCE FUNCTION Ergometer	
APPLIANCE CONCEPT NO./TITLE Erg	ometer
INDEX NO	REF. NO. 94, Skylab unit
DESCRIPTION	•

The ergometer is a bicycle-type, floor-mounted exercise machine with handlebars, bicycle seat, bicycle pedals, and a chest board. The ergometer is designed to allow the crew to exercise in a zero-y environment, using either his hands or his feet to drive the ergometer. The ergometer is capable of automatically programing heart rate (100 to 200 beats per minute) which is accomplished by a feedback loop control in which the workload varies automatically to produce desired heart rates. The exercise is accomplished by manually pedaling which drives a DC torque motor. The work is released to the environment as heat. The rate of power application in the automatic mode shall be adjustable from 25 to 100 watts per minute. The manual mode workload range is 25 to 300 watts.



#### APPLIANCE CONTROL PRODUCTIONS AND ARTER A PROPERTY AND ACCOUNT OF

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	IATOT	74.84 (165)	1.06 (37.5)
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TYPE UNITS/CYCL	(Prg.M E(FEF)	「/(:Rin )(((+)	(PKG, VOLVETER) (ÉEE) (1) × 15) (1) × 15) (17)
N/A			****
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APPLIANCE CONSERT FEMALE TESTS - SERVERTHER CARCELLATIONS 144 x 16 15 14 5. 2.1 WHITE LRGOINETER. III CTRICAL PONIF P1 48 11 1 21 61 5 P 0 V 1 P (1) (5) 0, 111 0 (C11 R17 (1) (PAT: 67) CYCLE PID. F 9170 CHILL) Certosi vi (Kir) (Hii ) (WALLS) (WATT') (WATTS) (RATIS) (1) (1) ELECTRUMICS . 15 .... TOTAL MAXIMUM 101/L THERMAL REQUIREMENTS LATERT SENSIBLE HLAT LEAK TO COOLIN. SOURCE (BTU/HR) (B10/HR) (BTU/HR) (BTU/dE) ALLENATOR POWER 683 DISSIPATINTO CABIN 200 (683) **JATOT** WATT (BTU/HP) WATT (LITU/HR) WATE (BIU/HR) WATE (DITTER) OPERATIONAL PENALTIFS THETHAL
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